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The Committee on Papers and Publications respectfully call attention to the resolutions of the Society, requiring that papers be submitted to the Committee before being read.

Authors will be furnished, gratis, with 20 reprints of each article published in the Journal, if application for the same be made when the article is sent.

Members are requested to give notice of any change of address, or failure in the delivery of the Journal. All communications relating to the Journal should be addressed to the Editor.

A. A. BRENEMAN, 97 Water St., New York.

REPORT OF THE TREASURER OF THE AMERICAN CHEMICAL SOCIETY FOR THE YEAR 1887.

1887.			1887.	
Jan. 1.	To balance	$288 49	By total expenditures	$1,058 02
Dec. 31.	To total receipts	1,083 21	By balance	313 68
		$1,371 70		$1,371 70

Detailed Statement of Receipts.

Donation for book-binding	$14 75
Sale of odd numbers of Journal	6 50
Reprints and extra printing, and advertisements	16 87
Dues collected from Members	1,045 09
	$1,083 21

Detailed Statement of Expenditures.

Journal	$577 52
Expenses of Treasurer	86 05
" Librarian	41 35
" Editor	3 39
" Recording Secretary	37 38
" Nominating Committee	7 63
Gas	7 70
Rent	250 00
Janitor	32 50
Insurance	7 50
Collector	6 50
Type-writing	50
	$1,058 02

Comparison of 1887 with 1886.

	1887.	*1886.*
Receipts	$1,083 21	$1,168 39
Expenditures	1,058 02	1,383 52
Excess to Dec. 31	263 30	288 46

Respectfully submitted,

James H. Stebbins, Jr.,
Treasurer.

LEGISLATION ON FERTILIZER ANALYSIS.

BY DR. BRUNO TERNE.

The last report of the New Jersey Agricultural Experimental Station, stated that the determinations of the available phosphoric acid are made at a temperature not exceeding 100° F., equal to 40° C.

Knowing that the temperature for determination of the available phosphoric acid had been raised to 65° C. or 150° F. several years ago, and not being aware of any exceptions to this rule, I opened a correspondence with some of the leading chemists, both State officials and consulting chemists. The answers of these gentlemen are sent herewith (see Appendix), and give a fair picture of the present state of the determination of reverted phosphoric acid.

It may, perhaps, seem a small matter if a State, as New Jersey, legislates at her own pleasure and does not keep pace with the progress of her neighbors ; but when, by such action, the reputations of a large number of manufacturers are jeopardized, it seems to be opportune to call the attention of the public to the fact, and show the unreasonable action of the legislative body of our neighboring State.

According to the letters of the New Brunswick station, since the adoption of the raised standard temperature by the convention of official State chemists, the representative of this State has withdrawn from such convention. We think the agricultural station has done something which had better not been done at all.

The gentlemen of the State institution should either have declared the adoption of a higher temperature to be wrong, and have shown their reason for it, or they should, at the first session of the legislature of the State, after the Atlanta Convention of Agricultural Chemists, have reported to this body that, after new researches, the Convention of State Chemists had adopted a new standard temperature, and, in order to be in concert with all analytical work, begged to amend the fertilizer law accordingly. When Massachusetts had done this very same thing (as the letter of the State chemists shows), could there be any doubt that any intelligent body of legislators would decline to take the advice of the Convention of

Agricultural Chemists? We do not believe it. Therefore, we claim that the station of New Jersey has more seriously hurt the interests of the manufacturers of its own State than those of others. Still manufacturers of the neighboring States of Pennsylvania and New York, who deal extensively with New Jersey, are put in a very peculiar position. They are law-abiding in their own States and yet fall short in another. Now, when we know how difficult it is to get uniformity in the results in determinations under exactly similar circumstances—I refer to Bulletin No. 16, U. S. Department of Agriculture, 1887, pages 36 and 37, where differences of 1.04%, 0.7%, 0.78% in the determination of available phosphoric acid in the samples is shown—what can we expect when the conditions of the analytical work are different; and when to the want of accuracy of the work is added a standard difference of the result, by an arbitrary rule requiring work at different temperatures?

Already, in the AMERICAN CHEMICAL JOURNAL, 1884, Vol. 6, Mr. Thomas P. Gladding has shown what influence the temperature has on the solvent qualities of ammonium citrate solutions, and, mainly on the strength of the researches of Mr. Gladding, the temperature has been raised to 65° C.

The Convention of Official Chemists at Atlanta in 1884 adopted the higher temperature as standard. We, therefore, were of the opinion that the universal standard temperature was also ruling in our neighboring State until we found our error. We tried to find out what difference it will make in mixed fertilizers, dissolved goods.

In our Double Eagle Phosphate we obtained the following results:

	65° C.	40° C.
Total available phosphoric acid	7.68	7.04
Insoluble " "	4.80	5.44
Total	12.48	12.48

A difference of 0.64%; and in a sample of Am. Phosphate, received from Mr. Gascoyne, Richmond:

	65° C.	40° C.
Total available phosphoric acid	8.71	7.63
Insoluble " "	1.72	2.80
Total	10.43	10.43

A difference of 1.08%.

If we now calculate their valuation on the basis of each method, we find it to be, per ton, as follows :

FIRST SAMPLE.

	U. S. Method, 65° C.	New Jersey Method, 45° C.
Available phosphoric acid, @ 8c....	$12 98	$11 26
Insoluble " " " 2c....	1 92	2 16
Total value..............	$14 20	$13 42

Difference, 78 cents per ton.

SECOND SAMPLE.

	U. S. Method, 65° C.	New Jersey Method, 45° C.
Available phosphoric acid, @ 8c....	$13 92	$12 20
Insoluble " " " 2c....	68	1 12
Samples of Acid Rocks, Sheet 249.		
Total value..............	$14 60	$13 32

Difference, $1.38 per ton.

SAMPLES OF ACID ROCKS.

	U. S. Method. 65° L. P_2O_5	N. Jersey Method. 40° L. P_2O_5
Total available phosphoric acid....	12.16%	11.52%
Insoluble " "	4.48%	5.12%
Total " "	16.64%	16.64%

Difference, 0.64%.

Valuation per ton; Available phosphoric acid, 8 cts.; insoluble, 3 cts.

Available	$19.45	$18.43
Insoluble........................	2.68	3.06
	$22.13	$21.49

Difference, 0.64 cts. per ton.

If the chemical management of any works outside of the State of New Jersey adds to the first sample, 3% ammonia, the valuation will be, everywhere, $25 per ton; that is to say, its retail price will reach the valuation of the stations, but in New Jersey it will fall short 78 cents per ton. And so, in the second sample, which, by addition of ammonia or potash, may be brought to any desirable standard, the difference in valuation between the other States of the Union and New Jersey will be $1.38 per ton.

What is the consequence of this difference? The New Jersey station controls the fertilizers sold each season in that State. The names of manufacturers are branded with the stigma of undervaluation of their goods, only because the State of New Jersey has not altered her law, and has not enabled her control station to act in concert with all the other agricultural stations of the Union.

It is in itself a foolish attempt to regulate chemical methods of analysis by legislative action, binding the officials of a commonwealth to certain methods, which may be found wanting and be replaced by new and better ones at any moment.

The adjustment, by rule, of the methods of chemical analysis for the regulation of the fertilizer trade should be left to the Convention of Agricultural Chemists, and such methods as are approved by this Convention, from year to year, should be binding upon all interested therein.*

The methods for the analysis of fertilizers, as now adopted, are very far from being faultless, and their incompleteness is the source of continuous research for new or improved methods.

But in justice to the manufacturer, uniformity of methods must at least be claimed. The fair name of any business house, which, in good faith and with continuous scientific control of its products, lives up to the regulation of the Convention, is sacri-

* The rules and regulations for inspection of fertilizers just presented by the Committee of Agriculture, State of Georgia, for 1887–1888, have been made precisely in this way.

[New Series, Circular No. 98.]

RULES AND REGULATIONS FOR THE INSPECTION OF FERTILIZERS IN GEORGIA, FOR THE SEASON OF 1887–8.

XIV. (p. 6.) The method of analysis recommended by the recent Convention of Agricultural Chemists, held at Washington, D. C., on the 28th of July, 1887, with such modifications as were adopted by the Atlanta Convention of May 15, 1887, and subsequent Conventions of the same Association, will continue to be employed by the Chemists of this Department in the analysis of all commercial fertilizers.

ficed by the inactivity of the Board of Agriculture of the State of New Jersey. The manufacturers in this State should, in the first place, take this matter in hand in their own behalf, and urge an amendment of the fertilizer law which will avoid the stipulation of any chemical method, but leave this part to the regulation of the State Board of Agriculture, which, it is to be taken for granted, will not be found in opposition to the progress of chemical research, and the adoption of rules made by the Convention of Official Agricultural Chemists.

DELAWARE RIVER CHEM. WORKS, Philadelphia.

APPENDIX.

NEW BRUNSWICK, N. J., Oct. 2, 1887.

DEAR DR. TERNE : I have just returned from a week's trip through the southern counties of this State, and hasten to reply to your favor of the 27th September.

This State fertilizer law provides that all determinations of available phosphoric acid must be made at a temperature not exceeding 100° Fah. For this reason I have not attended any of the conventions held by State chemists since the Atlanta meeting, when the change to 150° Fah. was proposed. I regret that I have no copies of the transactions of recent conventions, but will immediately write to my friend, Dr. Jenkins, of Conn., and ask him to mail you the last report.

Yours truly,
ARTHUR J. NEALE.

CHAS. H. STILLWELL,
THOMAS S. GLADDING.

OFFICE AND LABORATORY OF STILLWELL & GLADDING,
ANALYTICAL AND CONSULTING CHEMISTS,
NO. 55 FULTON ST., COR. CLIFF ST.,
NEW YORK, Oct. 5, 1887.

DR. BRUNO TERNE.

Dear Sir: We use 65° C., and have heard nothing about a return to 40° C. We have not heard what was done at the convention of State Chemists at Washington last August.

Yours truly,
STILLWELL & GLADDING.

OCTOBER 7, 1887.

DEAR SIR : I learn from Dr. Gascoyne that they made no change in the temp.

In N. J. the law prescribes a temp. of 100° F.; so the chemists have to follow it.

Yours truly,
CHAS. H. STILLWELL.

DR. W. J. GASCOYNE,
Chemist.

COMMONWEALTH OF VIRGINIA,
DEPARTMENT OF AGRICULTURE, CHEMICAL LABORATORY,
RICHMOND, VA., Oct. 5, 1887.

DR. BRUNO TERNE, Philadelphia, Pa.

Dear Sir: Your favor of the 4th inst. is just to hand. New Jersey is the only State in which the law prescribes the temperature at which the determination shall be made (40° C.).

In all other States is used the methods of the convention of Off. Chemists, 65° C.

You will receive a copy of the methods from our secretary in a few days.

I will send you the P_2O_5 samples to-morrow or next day.

In haste, very truly yours,
W. J. GASCOYNE, PH. D.

LABORATORY,
G. A. LIEBIG, PH. D.

BALTIMORE, Oct. 15, 1887.

DR. BRUNO TERNE.

Dear Sir: In reply to your favor of yesterday I beg to say that I generally use the oxal. am. solution to determine amount of reverted P_2O_5.

If specially ordered to employ the citr. am. solution, I use 65° C. temperature.

Am not aware that any other temperature is used.

Very respectfully,
G. A. LIEBIG.

DR. T. R. WOLF,
Analytical and Consulting Chemist.

NEWARK, DEL., Oct. 13, 1887.

DR. BRUNO TERNE, Philadelphia.

Dear Sir: Your letter of the 4th inst. was duly received, but owing to the great pressure of official duties, the matter was en-

tirely overlooked. In reply to your query I would say that I digest at 65° C., as recommended by Dr. Gladding.

Yours truly,

T. R. WOLF.

UNIV. OF PA., Oct. 5, 1887.

DEAR SIR: There is no law in this State as to which methods are to be used in analysis. I always use for the determination of reverted P_2O_5 citrate of ammonium solution for thirty minutes at 65° C.

Yours truly,

F. A. GENTH.

C. A. GOESSMAN, PH. D.,
Director of Experiment Station.

MASSACHUSETTS AGRICULTURAL EXPERIMENT STATION,
AMHERST, MASS., Oct. 12, 1887.

DR. BRUNO TERNE, Philadelphia, Pa.

Dear Sir: For several years past I used in my analysis of superphosphate, etc., as State Inspector of Fertilizer, the temperature 65° C. for one-half hour for the determination of the citrate ammonia soluble phosphoric acid. Years ago our State law required 40° C. Nothing but the desire to secure conformity of modes of analyzing fertilizer have induced me to make the change.

I am, yours respectfully,

C. A. GOESSMAN.

ABSTRACTS.

GENERAL AND INORGANIC CHEMISTRY.

On the Different Forms of Tellurium. M. BERTHELOT and CH. FABRE.

With a view to study the heat produced by the passing from the amorphous to the crystallized state, bromine and water saturated with bromine were employed, the two liquids dissolving tellurium without yielding any gas.

Crystallized tellurium: Three determinations at 13°, for one equivalent (Te=64), the average heat was + 33.33 Cal.

Amorphous tellurium: precipitated by SO_2. Three determinations: 21.292 Cal.

2d. Tellurium; precipitated from tellurides average + 33.39 Cal.

3d. Tellurium from hydrotelluric acid: Precipitated by oxidizing agents; average 33.505 Cal.

Hence crystallized Te changed into amorphous Te yields .... + 12.096 Cal.

The result is the establishing of the existence of two allotropic states for tellurium, and there is parallelism between the states of sulphur and tellurium, for similar physical and chemical conditions. (*Bul. Soc. Chim.*, **49**, *692.*) M. L.

Heat of Formation of Hydrotelluric Acid. BERTHELOT and CH. FABRE.

The gas is prepared by the action of HCl on the magnesium telluride (prepared by passing Te over Mg heated in a stream of pure and dry H).

For the calorimetric studies the reaction of ferric chloride with hydrotelluric acid is employed. The result is

H (gas) + Te (crystallized) = HTe (gas) .... —17.52 Cal.

The formation of TeH from its elements occurs, then, with absorption of heat. The combination of H with the elements of the

sulphur family yields quantities of heat represented by numbers decreasing as the *equivalent* weight of the element increases. Thus

H_2+S_2 cryst.$=H_2\ S_2$ (gas)*..................+ 4.6 Cal.
H_2+Se_2 metals.$=H_2\ S_2$ (gas)..................—12.3 Cal.
$H_2+Te_2=H_2\ Te_2$ (gas)..................—17.5 Cal.

(*Bul. Soc. Chim.*, **49**, *694.*) M. L.

Action of Hydrogen Sulphide on Arsenic Acid. B. BRAUNER and F. TOMICEK.

Upon passing a stream of hydrogen sulphide through aqueous arsenic acid, or an acid solution of an arseniate, the more *arsenic pentasulphide* is formed :

(*a.*) The larger the quantity of hydrochloric acid present ;

(*b.*) The larger the quantity of hydrogen sulphide passed in a unit of time ;

(*c.*) The lower the temperature (between 0–100°).

The more *arsenic trisulphide,* mixed with sulphur, is formed :

(*a.*) The less the hydrochloric acid present ;

(*b.*) The less the quantity of sulphuretted hydrogen used ;

(*c.*) The higher the temperature. (*Jour. Chem. Soc.*, **53**, *145.*)

W. P. M.

Action of Hydrogen Sulphide on Arsenic Acid. L. W. McCAY.

The author believes he has separated free sulphoxyarsenic acid, by acidifying a dilute solution of an alkaline arseniate with sulphuric acid, and then acting upon the latter with a small quantity of H_2S water. Although a potassium salt of this acid has been prepared, it has always been held that the acid itself is too unstable to exist in the free state. The work on this subject will be continued. (*Chem. News*, **57**, *54.*) W. P. M.

* O—8.

Direct Fixation of Free Nitrogen of the Air by Vegetable Soils. M. Berthelot.

The conclusion is that vegetable soils continually assimilate free nitrogen of the air. The gain of a soil in nitrogen could not be attributed to the nitro-compounds existing in the atmosphere or in solution, for in the experiments of the author the rain water would carry off, in the form of nitrate alone, more nitrogen than the same rain would have brought in the form of ammoniacal and nitric nitrogen together. Nevertheless the fixation of nitrogen is greater in a soil washed by rain than in a soil under cover; probably on account of the greater activity given to the organisms which assimilate nitrogen directly, by this circulation of air and water.

The author continues the study of the fixation of nitrogen by soils in the presence of vegetation as before and enumerates here his results tending to prove that plants liberate again the nitrogen assimilated from the atmosphere by the soil. (*Bul. Soc. Chim.*, **48**, *684*.) M. L.

Researches on Drainage. Berthelot.

The author has found that the drainage waters from rain take away from the soil a quantity of nitrogen (combined) much greater than the amount brought by the atmosphere and by the rain. In the conclusion of the paper he states that the amount of nitrogen carried away by drainage is 24 or 26 times the amount brought by rain, the limits being from 5:1 to 50:1. (*Bul. Soc. Chim.*, **48**, *684*.) M. L.

Researches on the Emission of Ammonia by Vegetable Soils. Berthelot and André.

These soils emit ammonia spontaneously, owing to the slow but necessary decomposition of the amides and ammoniacal bodies of the soil in the presence of water, to the decomposition of the carbonates, and probably also to physiological causes. The presence of free ammonia in the air surrounding the soil does not prevent this emission.

The emission of ammonia by a soil covered with vegetation in free air and in confined air has also been studied. The conclusion

is that there is no relation between the time of contact of a soil with atmospheric air and the proportion of NH_3 yielded by it; on the contrary the emission of NH_3 by a confined soil is proportionate to the time. (*Bul. Soc. Chim.*, **48**, *678.*) M. L.

ORGANIC CHEMISTRY.

Mixed Acid Anhydrides. W. AUTENRIETH.

The preparation of the mixed anhydrides by means of acetic anhydride is generally effected by heating the corresponding acid with 2–3 times the theoretical quantity of acetic anhydride in a flask, provided with a reflux condenser, for 15–30 minutes. After cooling, the product of the reaction is mixed with sodium carbonate in excess, to remove the acetic acid formed and decompose the excess of acetic anhydride. The mixed anhydride then separates as an oil.

Acetic-caproic anhydride, $C_6H_{11}O—O—C_2H_3O$, is a colorless liquid, lighter than water. The boiling point is not constant, the greater portion distilling between 165 and 175°. After continued heating, complete decomposition appears to take place, the thermometer rising above 200°.

Acetic-valerianic anhydxide, $C_5H_9O—O—C_2H_3O$, is very similar in its properties to the previous compound. The greater portion distils between 147 and 160°.

Acetic-β-thioethylcrotonic anhydride, $CH_3.C(SC_2H_3):CH.CO—O—CH_3.CO$, is a thick yellowish brown oil, which is heavier than water. Exposed to the air, it is gradually decomposed, the thioethylcrotonic acid separating in finely developed crystals. Concentrated nitric acid acts upon it very violently. With concentrated sulphuric acid the anhydride gives a dark red coloration. It does not show the characteristic dark green coloration of thioethylcrotonic acids, with isatine and sulphuric acid.

Acetic-benzoic anhydride, $C_6H_5.CO—O—C_2H_3O$. This compound, which was first obtained by Gerhardt, from chloracetyl and

sodium benzoate, may also be prepared from acetic anhydride by the above method. When benzoic acid is boiled with acetic anhydride for 2–3 hours, in a flask with reflux condenser, the yield of acetic-benzoic anhydride is very favorable.

Valeryl-phenylhydrazid, $C_6H_5.HN.NH.C_5H_9O$, is obtained by mixing acetic-valerianic anhydride with phenylhydrazine. The product of the reaction is dissolved in water, and acidified with acetic acid in excess, when the hydrazid separates in crystals. From hot petroleum ether these are crystallized in yellowish white plates, which are readily soluble in alcohol, ether and chloroform, but difficultly soluble in cold petroleum ether. The melting point is at 101°.

Capronyl-phenylhydrazid, $C_6H_5HN.NHC_6H_{11}O$, is obtained in the same manner as the previous compound. It crystallizes from petroleum ether in white needles, and melts at 116–117°.

Cinnamic acid, β-chlorocrotonic acid and other substituted fatty acids also give compound acetic anhydrides, in the above described manner. (*Ber. d. chem. Ges.,* **20**, *3187.*) W. R.

Homologues of Acetylacetone; General Methods for the Preparation of a Series of Diacetones, etc., etc. A. Combes.

The author having in previous papers studied the body called by him acetylacetone, continues his studies on its derivatives. By the action of sodium he obtains a metallic compound in which Na replaces one H atom of the central link CH_2, and he starts from this organo-metallic product to obtain the higher homologues, employing for this substitution the alcoholic iodides. By heating $C_5H_7O_2Na$ (sodium acetylacetone) with ethyl iodide, he obtains the ethylacetylacetone, CH_3—CO—CH (C_2H_5)—CO—CH_3, which boils at 178–179°. Its general properties are the same as acetylacetone; it does not combine with sodium bisulphide. The result of the decomposition of ethylacetylacetone by caustic potash is methylpropylcarbonyl, studied by Friedel, which combines with sodium bisulphide. The compound CH_3—CO—CH (C_5H_{11})—CO—CH_3, iso-amylacetylacetone, has been similarly studied. The author concludes with general considera-

tions relating to this new class of bodies, and says that the same reactions will allow the preparation of all the bisecondary glycols; he insists on the fact that the group CH_2, contained in acetylacetone, has very distinctly acid properties, the hydrogen atoms partaking of all the properties of the typical H of acids. From this it follows that the organo-metallic derivatives are really salts. (*Bul. Soc. Chim.*, **48**, *611*.) M. L.

On the Constitution of the Chlorinated Ethyl-bisulphide of Guthrie. W. SPRING and A. LECRENIER.

The authors recall the fact that Guthrie studied the action of ethylene on sulphur chloride, having obtained thus the bodies $(C_2H_4Cl)_2S_2$ and $(C_2H_3Cl_2)_2S_2$, and propose to investigate the chemical structure of these compounds. They first oxidize the body obtained by Guthrie $(C_2H_4Cl)_2S_2$; the lead salt of the acid obtained has the formula $(C_2H_4ClSO_3)_2Pb$. This salt is heated in sealed tubes in the presence of ammonia; the product boiled with lead hydrate to eliminate NH_3, yields crystals of taurine. The acid is β-chlorethyl sulphuric $CH_2Cl—CH_2SO_3H$, which, as is known, yields taurine, $CH_2NH_2—CH_2SO_3H$, whereas α-chlorethyl sulphuric acid, $CH_3—CHClSO_3H$, yields isotaurine. (*Bul. Soc. Chim.*, **48**, *629*.) M. L.

Calorimetric Measurements. BERTHELOT, LONGUISIENE and RECOURA.

The so-called calorimetric bomb of M. Berthelot (*Annales de Chem. and de Phys., 6^e serie,* **6**, *546, and* **10**, *433*) was employed for the determination of the heat of combustion of organic compounds, those being burned in O compressed to 24 atmospheres. The results of a series of confirmatory and new determinations are given:

Retene gave for 1 grm. 9.7181 Cal.

Naphthalene gave for 1 grm. $\left\{\begin{array}{l}9.696 \text{ Cal.}\\ 9.651 \text{ Cal.}\end{array}\right.$

Glucose $C_{12}H_{12}O_{12}$ (1 mol.) $\left\{\begin{array}{l}677.2 \text{ Cal.}\\ 669.\end{array}\right.$

Thus, in the formation of glucose from its elements,

$$C_{12}+H_{12}+O_{12}*(O=8)=C_{12}H_{12}O_{12}:+305 \text{ Cal.}$$

The result is that the combination of C with the elements of water to form this body would absorb —108 Cal. Studies upon the heat of formation of bodies that stand between the fatty and aromatic series are also described. (*Bul. Soc. Chim.*, **48**, *697, 700–702.*) M. L.

On Inactose of Neutral Sugar. E. J. Maumené.

The author refers to his previous paper on the formation of a sugar optically inactive, obtained by the action of the white powdered sugar of the refineries on silver nitrate. (*Journal des fabricants de sucre,* May, 1870.) The preparation recently attempted with pure sugars did not succeed so well; the reason assigned by the author is the presence of traces of alkali in the sugar first used, this alkali preventing the formation of the acid $C_{12}H_{12}O_{14}$, the presence of which produces a rapid inversion of the whole quantity of sugar present. The pure inactive sugar is isolated by treating the silver compound with calcium chloride. The filtered solution of sugar and calcium nitrate is separated by alcohol. The deposit of inactose is dissolved in a small amount of water and again treated with alcohol. The sugar does not crystallize; it retains its chemical properties in an alkaline solution, and does not reduce the cupro-tartaric solution. It is inverted more quickly than sucrose by acids; it combines with lime, but is separated from it by CO_2 and then remains inactive as before. (*Bul. Soc. Chim.*, **48**, *777.*) M. L.

Action of Chlorine on the Sulphides of the Alcoholic Radicals—Preparation of Some New Chloro-derivatives. W. Spring and A. Lecrenier.

One of the authors of this paper having, in collaboration with C. Winssinger, studied the action of Cl on the sulphuric derivatives of the fatty series, the authors have extended the investigation to include the sulpho-compounds. The result is that no

* O—8.

addition products are obtained by the action of Cl; the sulphur is entirely removed, while the hydrocarbon constituents are submitted to a more or less energetic chlorination. The general formula or equation representing the action of Cl on the sulphides would be

$$(C_nH_{2n}+_1)_2S+2Cl_2=(C_nH_{2n}+_1)2Cl_2+SCl_2$$

The final reaction being

$$C_nH_{2n}+_1Cl+Cl_2=C_nH_{2n}Cl_2+HCl.$$

The authors have studied the action of Cl on the sulpho-compounds of propyl, isobutyl and amyl (6 chloro-derivatives). The conclusion of their paper is that the hydrocarbon groups $C_nH_{2n}+_1$' behave towards Cl in different ways when free or when combined with sulphur. When the group $C_nH_{2n}+_1$ is combined with the latter element, chlorine seems to combine in preference with the atoms of carbon united to sulphur, taking hold of another atom only when the affinities of these latter have been satisfied. (*Bul. Soc. Chim.*, **48**, *623*.) M. L.

On few Derivatives of Saccharic Acid and of Mucic Acid.

M. MAQUENNE.

The author has found that saccharic and mucic acid act differently upon acetic anhydride in the presence of zinc chloride. Saccharic acid under these conditions yields a dilactone, mucic a tetracetyl derivative.

The author has combined mucic and saccharic acids with phenylhydrazine and describes the properties of the compounds obtained. He discusses the probable constitution of mucic acid and all other bodies of the same group. He regards them as acetonic hydrates comparable to mesoxalic or to dioxytartaric acids, but of a more stable nature. (*Bul. Soc. Chim.*, **48**, *719*.) M. L.

On some Chlorinated Derivatives of Acetic Ether.

MAURICE DELACRE.

A lengthy description is given of experiments on the substitution of Cl for H in acetic ether, the theory indicating the possi-

bility of 48 products of substitution. Two methods are employed for this study. The first is by letting the acetyl chlorides react on the chlorethylic alcohols. The second by the action of acetyl-chloride upon aldehyde. (*Bul. Soc. Chim.*, **48**, *704.*) M. L.

Combinations of Aldehydes and Glycols. H. LOCHERT.

A new compound has been obtained by heating a mixture of glycols and isobutylic aldehyde; the reaction is represented by

$$\left.\begin{matrix}CH_3\\CH_3\end{matrix}\right>CH-CHO+\begin{matrix}CH_2OH\\|\\CH_2OH\end{matrix}=H_2O+\left.\begin{matrix}CH_3\\CH_3\end{matrix}\right>CH-CH\left<\begin{matrix}OCH_2\\|\\OCH_2\end{matrix}\right.$$

The liquid obtained distils at 124–126°, is soluble in 10 parts of water, very soluble in alcohol and ether. $CaCl_2$ and KOH precipitate the body from its aqueous solution. Propionic aldehyde gives similar results with glycol. The formula of the compound is

$$CH_3-CH_2-CH\left<\begin{matrix}O-CH_2\\|\\O-CH_2\end{matrix}\right.$$

(*Bul. Soc. Chim.*, **48**, *716.*) M. L.

Oxydiphenyl Bases. A. WEINBERG.

Diamido-oxydiphenyl, $C_{12}H_{12}N_2O$. 300 gms. of sodium benzene azo-*p*-phenol-sulphonate are suspended in 500 gms. water, and to the mixture is carefully added a solution of stannous chloride in hydrochloric acid, care being taken to keep the temperature below 30°. After standing 12 hours the reaction is complete. The tin is removed by hydrogen sulphide, and the solution evaporated to small bulk, when the hydrochloride of diamidooxydiphenylsulpho acid separates in large, colorless, transparent crystals.

The free sulpho acid is prepared from the chlorhydrate by carefully neutralizing it, or by adding sodium acetate. It crystallizes in needles from water, in which it is readily soluble, and forms soluble salts with the bases.

The hydrochloride, heated to 180° with water, yields diamido-oxydiphenyl sulphate, which is sparingly soluble in water, but dissolves in warm dilute hydrochloric acid. Diamidooxydiphenyl hydrochloride is readily soluble in water. Platinic chloride pro-

duces in this solution a yellowish precipitate, $C_{12}H_8O.(NH_2.HCl)_2+PtCl_4+5H_2O$, which is sparingly soluble in water, and insoluble in alcohol and ether.

The free base is precipitated from its salts by soda. It crystallizes from water in colorless scales, melting at 185°. It is difficultly soluble in water, cold alcohol, ether and benzene, but readily soluble in soda or potash lye. The alkaline solutions quickly oxidize in the air. It easily forms a tetrazo-compound with nitrous acid.

Diamidooxyphenyltolyl, $C_{13}H_{14}N_2O$. The coloring matter obtained from *o*-toluidine and *p*-phenol-sulpho acid is reduced in the same manner as the aniline compound. The hydrochloride of diamidooxyphenyltolyl sulpho acid crystallizes from the concentrated solution freed from tin. On adding sodium acetate to the aqueous solution of the hydrochloride, the free sulpho acid immediately separates in colorless needles. The free acid when heated decomposes without showing any definite melting point, is difficultly soluble in water, very soluble in acids and alkalies, and forms a readily soluble tetrazo-compound.

Heated to 180° with water, the diamidooxyphenyltolyl sulpho acid immediately yields colorless crystals of diamidooxyphenyltolyl sulphate. The free base crystallizes from water in nacreous plates melting at 177°. It is difficultly soluble in ether and benzene, but dissolves easily in a dilute solution of potash, from which it is precipitated unchanged by acetic acid. The tetrazo derivative is very much like tetrazooxydiphenyl. (*Ber. d. chem. Ges.*, **20**, *3171.*)

W. R.

Derivatives of *p*-Amidoisobutyl Benzene. C. GELZER.

Mononitroacetylamidoisobutylbenzene. $(C_4H_9)(NO_2)C_6H_3.NHC_2H_3O$. Acetylamidoisobutylbenzene is added in small portions to nitric acid of sp. gr. 1.485, cooled by ice. It rapidly dissolves with an intensely yellow color. The reaction is quite violent, but with care the evolution of hyponitrous acid may be prevented. The product of the reaction is poured into an excess of ice water, and the resulting yellow, crystalline precipitate is filtered off, washed and purified by crystallization from dilute alcohol.

It melts at 104.5°. From a large quantity of hot water, or dilute alcohol, it crystallizes in fine yellow needles having a faint aromatic odor. It boils with partial decomposition at 250–252°. When a cold alcoholic solution of potash is added to nitroacetylamidoisobutylbenzene, the yellow solution changes to reddish yellow, with the evolution of much heat. On addition of water to the product an abundance of reddish yellow crystals of nitroamidoisobutylbenzene, $(C_4H_9)(NO_2)C_6H_3.NH_2$, separates. After repeated crystallization from dilute alcohol, the melting point is constant at 106.5°.

Diamidoisobutylbenzene, $C_4H_9C_6H_3(NH_2)_2$ is obtained by reducing nitroamidoisobutylbenzene with tin and hydrochloric acid. The tin is removed from the solution by zinc, an excess of sodium hydroxide added, and the solution is shaken out with ether. The etherial extract, after removing water with potassium hydroxide, leaves a yellowish brown, crystalline mass, which is purified by distillation in an atmosphere of hydrogen. It boils at 280–282°, and crystallizes in the receiver in pale yellow, radiated, crystalline masses. From water it is obtained in colorless, micaceous plates, melting at 97.5°. It sublimes readily in foliated crystals. On keeping, even in sealed tubes, it is at first colored pale blue, becoming darker, and finally dirty, dark blue. The sublimed base is permanent in the air. The base is soluble with difficulty in cold water, but readily soluble in boiling water, alcohol, ether and benzene. Its salts crystallize readily.

The hydrochloride, $C_{10}H_{16}N_2.2HCl$, is separated from the alcoholic solution of the base, on addition of hydrochloric acid, in white, shining plates. It is soluble in cold water and boiling alcohol, slightly soluble in cold alcohol, and insoluble in benzene and ether. The aqueous solution is colored cherry-red by ferric chloride. Potassium bichromate produces a brown, pulverulent precipitate.

The picrate, $C_{10}H_{16}N_2.2C_6H_2(NO_2)_3OH$, separates immediately on mixing benzene solutions of the base and picric acid, in light yellow needles. It is insoluble in cold water, sparingly soluble in boiling water and ether, insoluble in benzene and readily soluble in alcohol.

The oxalate $(C_{10}H_{16}N_2)_2 . H_2C_2O_4$, is prepared by mixing alcoholic solutions of the base and oxalic acid. It separates as a white, crystalline precipitate, which crystallizes from alcohol in fine white plates. It is soluble in boiling water, slightly soluble in boiling alcohol, and insoluble in ether. The alcoholic solution gives a fine green color with ferric chloride.—(*Ber. d. chem. Ges.*, **20**, *3253.*) W. R.

β-Chinolinedisulpho Acid. W. LA COSTE and F. VALEUR.

This acid is obtained by heating the barium salt with the theoretical quantity of standardized sulphuric acid, filtering off the barium sulphate, concentrating the filtrate and adding alcohol. On cooling it crystallizes in fine white needles, which are readily soluble in water, and insoluble in alcohol, ether, benzene and chloroform.

Potassium β-chinolinedisulphonate, $C_9H_5N\ (SO_3K)_2 + H_2O$, is prepared by decomposing the barium salt with potassium carbonate. It separates from its aqueous solution in white, crystalline, granular crusts, which are readily soluble in boiling water, soluble with difficulty in cold water, and insoluble in alcohol. Fused with three times its weight of potassium hydroxide at 160°, it yields basic potassium-β-oxychinolinesulphonate, which is readily soluble in water. On addition of dilute sulphuric acid to the solution, the free β-oxychinolinesulpho acid crystallizes in fine, yellow, lustrous plates, which are readily soluble in hot water, soluble with difficulty in cold water and alcohol, very sparingly soluble in chloroform and carbon disulphide, and insoluble in ether and benzene. They melt at 270–275°.

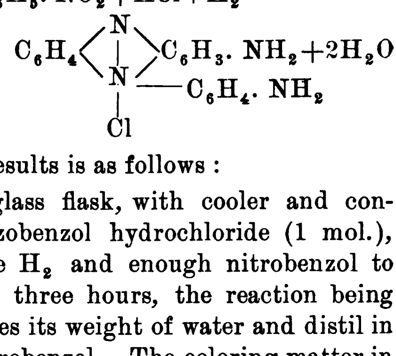
β-Dioxychinoline is prepared by fusing one part potassium β-chinolinedisulphonate with 5 parts potassium hydroxide at 250–255°. The melt, after cooling, is dissolved in water, decomposed with sulphuric acid, and neutralized with sodium carbonate, after a portion of the potassium sulphate has crystallized out. The separated flocculent base is shaken out with ether. After distilling off the ether, the base remains as a dark oil, which crystallizes on cooling. It is dissolved in alcohol, boiled with freshly ignited bone black and filtered. On addition of water the base crystallizes in pale brown needles, which are soluble in ether, alcohol, benzene,

chloroform and carbon disulphide, and insoluble in water and alkalies. β-dioxychinoline is very permanent in the air, melts at 68° C., and sublimes at a higher temperature in fine white needles. With acids it forms permanent salts, which can only be crystallized with difficulty from their solutions. (*Ber. d. chem. Ges.*, **20**, *3199*.) W. R.

New Method of Formation of Safranines. PH. BARBIER and LEO VIGNON.

The authors have thought that if they could make amidoazobenzol react on nitrobenzol in the presence of a reducing agent, capable of yielding H_2, phenosafranine might be formed, the nitrobenzol furnishing the oxygen and also the nascent aniline necessary to the equation :

$$C_6H_5—N=N—C_6H_4 . NH_2 + C_6H_5 . NO_2 + HCl + H_2 =$$



The method giving the best results is as follows :

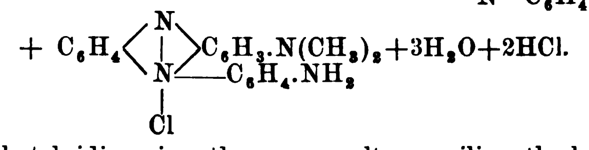
Heat on oil bath at 180° in a glass flask, with cooler and condenser, a mixture of amido azobenzol hydrochloride (1 mol.), enough Fe and HCl to evolve H_2 and enough nitrobenzol to give convenient fluidity. After three hours, the reaction being ended, treat the mass with 5 times its weight of water and distil in a current of steam to remove nitrobenzol. The coloring matter in solution is precipitated by salt. The pure coloring matter is very soluble in hot water, with a red coloration; crystallizes readily on cooling; soluble in alcohol, the solution being dichroic; is not precipitated by alkalies ; the solution in strong sulphuric acid is green, passing through blue to red on addition of water. (*Bul. Soc. Chim.*, **48**, *771*.) M. L.

On a new mode of formation of substituted Safranines. PH. BARBIER and L. VIGNON.

By the reaction of para-nitrosodimethylaniline hydrochloride on aniline in alcoholic solution, the authors have obtained the two

bodies: tetramethyldiamidobenzol and dimethylphenosafranine, the formation of which they represent by

$$3\left[C_6H_4 \begin{matrix} \diagup N(CH_3)_2HCl \\ \diagdown NO \end{matrix}\right] + 2(C_6H_5NH_2) = \begin{matrix} N-C_6H_4.N(CH_3)_2 \\ \| \\ N-C_6H_4.N(CH_3)_2 \end{matrix}$$



Orthotoluidine gives the same results as aniline, the homologues of the above bodies being obtained. (*Bul. Soc. Chim.*, **48**, *636*.)

M. L.

ANALYTICAL CHEMISTRY.

A Criticism of the Direct Methods for Determining Tartaric Acid in Lees, Argols, etc. By A. Borntrâger.

The conclusions arrived at by the author's criticisms are that the oxalic acid method should be applied as follows to lees, argols, sablons, etc.:

1. For a preliminary analysis, weigh out 7.5 grms. lees, or 3.75 grms. argol. Of tartrate of lime weigh out, according to purity, from 3.75 to 7.5 grms. 3.75 grms. c. p. calcium tartrate (+ $4H_2O$) contain 2.1638 grms., 7.5 grms. (92.20% pure) contain 3.9894 grms., the same quantity with 16% tartaric acid contains 1.2 grms. of the latter. These data apply only to tartrates of lime which have not been dried above 60° C.

For sablons use a quantity proportionate to the tartaric acid in the same as above. The sample taken may contain from 1.2 to 4.0 grms. tartaric acid. The weighed amount of the freshly pulverized sample is treated with 30 c.c. water, and heated until all effervescence ceases. Neutralize the mass with KOH solution or HCl, as required, leaving it slightly acid, and then proceed to determine the quantity of potassium oxalate required to precipitate all the lime. Add 1.5 grms. $K_2C_2O_4$, and heat on boiling water bath for 10 min.

Test the filtrate, acidulated with acetic acid, for oxalic acid. If absent add another 1.5 grms. $K_2C_2O_4$, and heat again, etc., and continue the addition of $K_2C_2O_4$ until the filtrate shows the presence of oxalic acid.

2. For the actual analysis an accurately weighed amount is taken and heated on a water bath with 30 c.c. water as above and 1.5 grms. more of oxalate than was found to be required by the above preliminary test; heat for 15 m.; neutralize as required, leaving the solution slightly acid; continue the heat with frequent stirring for $\frac{3}{4}$ hour. Almost neutralize the mass and filter while hot through a vacuum filtering funnel. Wash with hot water until the washing no longer contains oxalic acid. If the filtration proceeds too slowly the modified method of Grosjean (J. Ch. Soc., **35**, 346) should be followed, by which a larger quantity of material is taken for the analysis, and then, without filtering, the whole is diluted to a considerable volume and a proportional part of the filtrate taken for the further determination of the tartaric acid. The volume occupied by the precipitate must be determined. By this modification it is best to add 100 c.c. of hot water to the material before the final neutralization.

The filtrate with washings, or an aliquot part of the filtrate, is evaporated after the addition of 5 grms. KCl to about 50 c.c.; after cooling 3 grms. citric acid, in 50% solution or crystals, are added. Stir for 10 minutes and filter after $\frac{1}{2}$ hour, or stir for a few minutes and let stand over night. The bitartrate precipitate is washed with the 10% KCl solution saturated with $KHC_4H_4O_6$ until the washings give no indication of oxalic acid after the addition of acetic acid and calcium acetate. The precipitate is titrated, hot, with normal KOH solution. (*Zeit. Anal. Chem.*, **26**, *699-714.*) J. F. G.

Volume and Quantity of Carbon in the Gases Evolved by the Solution of Iron in Acids. H. Bäckström and G. Paijkull.

The following table gives the results of these investigations:

Total C %.	Name.	C. C. Gas from 1 grm. iron.	% Carbon in gas.
0.00	Pure iron should give	399.6	....
0.11	Eggertz normal wire	398.7	....
0.20	Iron wire	396.9	....
0.26	Eggertz normal wire	392.5 393.6	0.180 0.165
0.50	Iron wire from Bofors	378.5	0.346
0.60	" " "	386.3	0.356
0.60	Iron	391.3	....
1.00	Steel wire from Bofors	356.0	0.242
1.00	Bessemer steel with 0.13 % graphite	383.2 380.2	0.776 0.645
1.30	Eggertz normal wire	353.3	0.492
3.28	White pig iron with 41 % graphite	297.8 298.4	1.94 2.12
3.80	Gray " " 3.45 % "	383.	....
3.87	White pig iron, dissolved in sulphuric acid	295.7 290.8 282.8	2.245 2.276 2.235
	" " dissolved in hydrochloric acid	309.5 311.1	2.546 2.552
3.90	Gray pig iron with 3.55 % graphite	372.0	....
4.24	White " "	296.3	2.806
6.37	Ferromanganese, 84.3 % mn. + 7.72 % Fe	287.5	3.80

It appears, therefore, that the combined carbon is not all evolved as hydrocarbon, and that the volume of gas and the per cent. of carbon in the same are not proportional to the combined carbon contained in the iron; also, that hydrochloric acid generates a greater volume of gas with higher per cent. of carbon than sulphuric acid under the same conditions.

The gas evolved from hardened steel is greater in volume and contains more carbon than that from unhardened steel. Thus, 1 grm. of steel with 1 % carbon gave 356 c.c. gas (with 2.5 mgm. C.), and after hardening 386.1 c.c. (with 8.8 mgm. C.), while after having been hammered, cold, it gave but 345.1 c.c. gas (with 1.2 mgm. C.). (*Zeit. anal. Chem.*, **26**, *683–689.*) J. F. G.

Iodide Coatings and Sublimates. WHEELER and LUEDEKING.

A mixture of 40 % iodine and 60 % sulphur is made. To obtain the coatings, by means of the blowpipe, mix the substance to be tested with about an equal quantity of the sulphur-iodine mixture, and heat in the oxidizing flame of the blowpipe on small "Plaster of Paris" tablets, prepared by allowing "Plaster of Paris" paste to harden on oiled glass plates and then cutting it into suitable sized tablets. The following are the colors of the coatings obtained as above:

Arsenic and antimony—orange red.
Mercury—scarlet red and yellow, the red finally becoming yellow.
Selenium—reddish brown.
Lead—chrome-yellow.
Silver—hot, bright yellow; cold, light grayish yellow.
Tin—brownish yellow.
Bismuth—chocolate brown, red at the edges while hot.
Cobalt—grayish brown, green at the edges; the brown finally turns green.
Tellurium—purplish brown.
Molybdenum—ultramarine blue.
Tungsten—light greenish blue.

Copper, cadmium and zinc all give white coatings, that of zinc being very volatile. Treatment with ammonium sulphide vapor serves to distinguish the three. The coating with bismuth becomes scarlet red when treated with ammonia vapors. (*Zeit. anal. Chem.*, **26**, *602–604*.) J. F. G.

Estimation of Chlorates by the Zinc-Copper Couple. C. H. BOTHAMLEY and G. R. THOMPSON.

The reduction of chlorates to chlorides, followed by titration, usually gives results which are too low. The authors show the error to be due to partial conversion of the reduced chloride into insoluble zinc oxychloride, which conversion increases with the concentration of the chlorate solution. The error due to this cause may be removed by slightly acidifying with sulphuric acid. (*Jour. Chem. Soc.*, **53**, *164*.) W. P. M.

Estimation of Iodine. NORMAN MCCULLOCK.

A volumetric method, the capabilities of which the author hopes to develop later. The titration is done with potassium permanganate, in presence of sulphuric acid and an excess of hydrocyanic acid. The latter acid causes formation of colorless cyanogen iodide, according to the equation :

$$2K_2Mn_2O_8+10HI+10HCN+6H_2SO_4=2K_2SO_4+4MnSO_4+10CNI+16H_2O$$

Without the HCN, free iodine would separate, and obscure the "end reaction." (*Chem. News*, **57**, *45*.) W. P. M.

Determination of Solids and Fat in Milk and Butter. F. GANTTER.

The author uses wood pulp, prepared by the sulphite process, as a substitute for sand, gypsum to facilitate the drying and subsequent extraction of fat. (*Zeit. anal. Chem.*, **26**, *677–680.*)

J. F. G.

INDUSTRIAL CHEMISTRY.

Bang's Process for the Detection and Separation of the Impurities of Alcohol.

The principles on which the process repose are :

1st. The head products of the distillation (aldehydes and ethers) are insoluble in the liquid hydrocarbons, but are converted into soluble products by alkalies. The polymerized products are soluble also in alcohol, to which they give a certain color.

2d. The tail products are entirely soluble in the hydrocarbons, whereas diluted alcohol is not.

3d. Strong sulphuric acid entirely removes the soluble bodies dissolved in the hydrocarbons.

Detection of the head alcohols : Take 50 or 60 c. c. of the alcohol to be tested, and mix with concentrated potash or soda ; heat on the water bath at about 60°. If the alcohol contains head pro-

ducts, it takes a color varying from straw yellow to black. The same reaction takes place after a longer time without heating.

Detection of the tail distillates: Take the same amount of alcohol as before, and shake with a light hydrocarbon, added in small portions until no further solution occurs. Dilute with 5 volumes of water. Decant the separated hydrocarbon, and shake with a few c. c. of conc. H_2SO_4. The coloration of the acid is yellow when isobutylic acid predominates, and brown when amylic alcohol is in excess.

The same reactions permit the detection of adulteration of wines with impure alcohols. The author has applied these principles to the industrial purification of alcohols. (*Arch. de Pharm.*, 2, *487.*) M. L.

Abstracts of American Patents Relating to Chemistry.

(*From the Official Bulletin of the U. S. Patent Office.*)

December 13th, 1887.

374,618.—Obtaining ammonia from manure, etc. W. F. Nast.
An alkaline base is added to the manure, after which it is treated with sodium chloride, or other chloride.

374,686.—Distilling wood. A. Smith.

374,716.—Manufacture of white lead. W. B. Talbot.

374,740.—Explosive compound. L. G. Heusschen.
Consists of coal oil and glycerin, together with potassium or sodium nitrate, a sulphate, and sulphuric acid.

December 20th, 1887.

374,921.—Blasting powder. G. Antheunis.
Consists of mahogany sawdust, sodium nitrate, charcoal, sublimed sulphur, potassium ferrocyanide, and ammonium picrate.

375,060.—White pigment. J. B. Freman.
Consists of lead sulphate, zinc white, and barium sulphate.

375,085.—Gas retort furnace. G. A. McIlhenny.

375,161.—Apparatus for making fuel gas. A. C. Huidekoper and L. Houze.

December 27th, 1887.

375,405.—Method of manufacturing non-blooming vulcanized soft rubber. F. Wilhoeft.
Rubber is mixed with a compound, consisting of sulphur and a greasy, fatty, resinous or turpentine-like body.

375,436.—Recovering and utilizing waste rubber. S. M. Allen.
Rubber scrap is heated with a mixture of non-volatile oil, asphalt, resin and sulphur.

375,455.—Process of and apparatus for tanning. A. Millochan and F. Chailly.
The tanning liquor and hides are placed in a closed vat or pit, and atmospheric air is passed through the vat by injecting it at the base, and withdrawing it at the top. The air charged with the tanning principles is repeatedly conveyed back to the base of the vats.

375,490.—Apparatus for distilling wood. G. Hunziker.

375,601.—Soluble food for infants and invalids. J. Carnrick.
Consists of peptonized and partially digested milk, and flour, in which the starchy portion is converted into soluble starch and dextrin.

375,606.—Process of treating sal ammoniac or flux skimmings. G. G. Convers.

375,611.—Apparatus for producing and washing carbonic acid gas. J. H. Digeon.

375,621.—Process of making vinegar. C. Gould.
Fruit and other juices are acidified, by receiving and confining the acid gases in a suitable receptacle as they rise from the liquid, and condensing and reincorporating the acid constituents of said gases into said liquid from time to time as the acidification progresses.

375,622.—Vinegar apparatus. C. Gould.

375,651.—Explosive. C. Roth.
Consists of the combination of an aromatic chlornitro-carburet with an oxidant, such as ammonium nitrate.

January 3d, 1888.

375,787.—Apparatus for drying starch or other solid matter. E. E. Duryea and P. H. Grimm.

375,845.—Tanning. L. M. Waer, J. H. Phillips and W. S. Kenzla.
Hides are tanned in a bath of yellow dock root, water and phenol.

375,848.—Manufacture of dyestuffs. A. Weinberg and H. Siebert.
A coloring matter produced by the action of tetrazoditolyl upon a new naphthylamine sulpho acid, described in the patent.

375,908.—Apparatus for distilling wood. J. Wilson.

375,917.—Composition of metallic alloys. H. Berglin.
Consists of copper, 83.23; tin, 3.48; zinc, 8.16; nickel, 4.92; antimony, 0.04.

375,930.—Production of orange azo dyestuffs. P. Friedlaender and B. Priebs.
A solution of tetrazoditolylchloride is prepared from tolidine sulphate, and to the solution is added a solution of metatoluylenediamine sulpho acid, and then a solution of salicylic acid. W. R.

JOURNAL

OF THE

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VOL. X.—NO. 2.

FEBRUARY,

1888.

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CONTENTS

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1888.

The Journal of the American Chemical Society appears monthly, except during July and August. It will contain all papers read before the Society, as well as abstracts from American and Foreign Journals, and a list of American Patents relating to Chemical Industries.

The Price of Subscription is $5.00 per year, in advance.

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The Committee on Papers and Publications respectfully call attention to the resolutions of the Society, requiring that papers be submitted to the Committee before being read.

Authors will be furnished, gratis, with 20 reprints of each article published in the Journal, if application for the same be made when the article is sent.

Members are requested to give notice of any change of address, or failure in the delivery of the Journal. All communications relating to the Journal should be addressed to the Editor.

A. A. BRENEMAN, 97 Water St., New York.

REGULAR MEETING, February 3d, 1888.

Vice-President Breneman in the chair.

The minutes of the December meeting were read and approved.

Mr A. W. Nebilius, of Landing, Now Jersey, was unanimously elected a member of the Society. John S. Adriance, of Huntingdon, Pa., was proposed as a member.

Dr. W. H. Kent read a paper on the "Determination of Fat in Milk."

The minutes of the meetings of the Board of Directors, held January 16th and 24th, were read.

Messrs. Endemann and Waldstein were appointed a committee to audit the Treasurer's accounts for 1887.

T. D. O'CONNOR,
Recording Secretary.

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Selenium—red
Lead—chrom
Silver—hot, l
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Bismuth—cl
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The Journal of the American Chemical Society appears monthly, except during July and August. It will contain all papers read before the Society, as well as abstracts from American and Foreign Journals, and a list of American Patents relating to Chemical Industries.

The Price of Subscription is $5.00 per year, in advance.

The Meeting Room and Library of the Society are at Room 1, University Building, Washington Square, New York.

The Regular Monthly Meeting is held on the first Friday of every month, at 8 P. M.

Corresponding Secretary:

M. ALSBERG, 54 Maiden Lane, New York.

Treasurer:

J. H. STEBBINS, Jr., 117 Pearl St., New York.

The Library will be open to Members regularly on Fridays, from 6 to 10 P. M., and at any other time on presenting to the Janitor of the University Building a ticket, which can be obtained of the Librarian.

Back numbers of the Journal are sold to Members at $3.00, to others at $5.00, per volume. Apply to the Librarian

WILLIAM RUPP, 117 Pearl St., New York.

The Committee on Papers and Publications respectfully call attention to the resolutions of the Society, requiring that papers be submitted to the Committee before being read.

Authors will be furnished, gratis, with 20 reprints of each article published in the Journal, if application for the same be made when the article is sent.

Members are requested to give notice of any change of address, or failure in the delivery of the Journal. All communications relating to the Journal should be addressed to the Editor.

A. A. BRENEMAN, 97 Water St., New York.

REGULAR MEETING, February 3d, 1888.

Vice-President Breneman in the chair.

The minutes of the December meeting were read and approved.

Mr A. W. Nebilius, of Landing, New Jersey, was unanimously elected a member of the Society. John S. Adriance, of Huntingdon, Pa., was proposed as a member.

Dr. W. H. Kent read a paper on the "Determination of Fat in Milk."

The minutes of the meetings of the Board of Directors, held January 16th and 24th, were read.

Messrs. Endemann and Waldstein were appointed a committee to audit the Treasurer's accounts for 1887.

T. D. O'CONNOR,
Recording Secretary.

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closed at one end with a little glass wool, and exposes the whole in a drying oven to a heat of 45° C. After all excess of water has drained off, a certain number of drops of a solution, containing the pepsin under examination, is allowed to trickle upon the jelly contained in the funnel. In about two minutes the liquid will begin to drop from the funnel, and the rate of dropping in a given time is said to be proportional to the strength or activity of the pepsin.

P. Grützner determines the value of pepsins by allowing flocks of fibrin, stained with carmine, to digest under similar conditions, and then estimating colorimetrically, at the end of a certain time, the intensity of the coloration of the liquid separated by decantation from the non-dissolved fibrin, by comparing it with a certain number of standard solutions of carmine. It is very easy to stain fibrin evenly with carmine, and, therefore, the intensity of the coloration of the solution is proportional to the amount of fibrin dissolved by the pepsin.

The methods I propose to discuss in this paper are three, viz.: the U. S. P. test, the Manwaring test and the Kremel test.

According to the experiments of numerous investigators, the peptic digestion of albuminoids depends upon several conditions.

1. The temperature.

The pepsin of fish acts energetically at 20° C., but the pepsin of mammals requires a higher temperature, and it has been found that peptonization is most active between 35° C.–50° C. Above this, digestion runs much slower and ceases totally towards 70–80° C.

2. The quantity of pepsin.

There being no such thing as absolutely pure pepsin, it has been impossible to determine, with accuracy, the amount of albumen which can be converted into peptone by a given quantity of the ferment. We know only that the amount is very large, provided that from time to time a little acid and water is added in order to maintain a certain degree of dilution.

The quantity of albuminoid which can be digested in a given time increases rapidly with the quantity of pepsin employed till it reaches a maximum, and then decreases slowly. The quantity

of peptone finally obtained increases with the proportion of pepsin.

3. The quantity of water.

As the products of digestion accumulate, the rate of peptonization gradually decreases. The addition of a fresh quantity of acidulated water causes the peptic action to recommence until it has reached a certain limit, beyond which the reaction ceases entirely.

4. The nature and quantity of the acid used.

A large number of acids may take the place of hydrochloric acid in peptic digestions, but none of them are as efficient as the latter. A. Mayer found that with the use of hydrochloric acid, complete peptonization occurred in from 3 to 5 hours; with nitric acid in about 5 hours, with oxalic acid in 13 hours, and with sulphuric acid in 19 hours.

According to Brücke, peptonization is already very active in a medium containing only 0.8 pts. of hydrochloric acid per 1,000, and attains its maximum, with a concentration of 1 pt. of acid in 1,000 of water. A too large proportion of acid hinders peptonization, 7 pts. of acid per 1,000 of water being sufficient to make the action very slow. Mayer thinks that the most favorable proportion of acid is 2 pts. per 1,000 water, or 0.2 per cent.

5. The time of action.

6. The variety and character of the albumen.

One of the most largely used tests in this country is the U. S. P. test, which reads as follows:

"One pt. of saccharated pepsin dissolved in 500 pts. of water, acidulated with 7.5 pts. of hydrochloric acid, should digest at least 50 pts. of hard boiled egg albumen, in 5 or 6 hours, at 100–104° F. (37.5–40° C.)"

The above test seems simple, but, in reality, it is unreliable and misleading, as no two persons using the same pepsin can obtain the same or even approximate results; it is, therefore, not surprising that we meet with such a diversity of conclusions.

The weak points in the above test are the following:

1. The test is based upon the amount of albumen which can be dissolved in a given time (including peptone and intermediary products), but does not take into consideration the

amount of peptone actually formed, and this I claim to be of the greatest importance.

2. It directs that a given pepsin shall digest at least 50 pts. of coagulated albumen. Now, in order to determine how much albumen has actually been dissolved, it is necessary to use an excess of albumen, and then weigh what remains undissolved. The test in question does not specify how much albumen shall be used, but leaves it entirely to the option of the experimenter. I consider this to be a weak point, as it makes quite a difference whether only a small or large quantity of albumen is used.

3. It is difficult to see how accurate results are to be obtained by weighing the amount of undissolved albumen remaining after a digestion, because it is impossible to find two samples of coagulated albumen, which contain exactly the same quantity of moisture; and besides this, the quantity of moisture is very liable to vary during the weighing, owing to the loss of moisture by evaporation.

4. It is not stated how long the eggs shall be boiled! This is a very important matter, as digestion differs greatly according to whether the eggs are boiled for a short or a longer time.

5. No provision is made for the size of the pieces of coagulated albumen. This, also, is very important, as it has been found that the greater the surface of the albumen exposed to the peptic ferment, the greater will be the amount of albumen digested.

6. This test applies only to saccharated pepsins, and no provision is made for other brands of pepsin.

It will, therefore, be seen that the U. S. P. pepsin test is absolutely unreliable and misleading.

Lately my attention has been called to a new pepsin test, which I will designate by its author's name, the "Manwaring test." In this test Manwaring has tried to avoid as much as possible the bad points of the U. S. P. test; but in doing this he has stumbled against other sources of error which I will try to make clear further on.

The test can best be described in the words of its author:

"The design of the following mode of testing the dissolving power of pepsin is to conform as nearly as possible to the U. S. P. test, which, contemplating the testing of the saccharated form,

makes no provision for the proportion of acidulated water to be used with a pure pepsin.

"On the basis that 1 part of a pure pepsin is capable of dissolving 1,000 times its weight of coagulated egg albumen in 6 hours, a saccharated pepsin made with a pure pepsin of U. S. P. strength would contain 5 per cent. of pure pepsin; therefore if 1 grain of a U. S. P. *saccharated* pepsin is to be tested in the presence of 500 grains of acidulated water, then 1 grain of a pure pepsin should be tested in the presence of 10,000 grains acidulated water, to equal the same proportion of water and acid used for the *actual* quantity of pure pepsin contained in a U. S. P. saccharated pepsin when tested according to the U. S. P."

In order to render the weighing of small quantities of pure pepsin as easy as possible to the pharmacist, Manwaring recommends that it should be saccharated, and for this purpose he gives the following recipe:

R. Saccharated pepsin, consisting of:

Pure pepsin .... 1 grm.
Milk sugar...................................19 "

To make the test take of the above saccharated pepsin 0.3 grm. (= 0.015 grm. pure pepsin).

Coagulated egg albumen.................... 22.5 grms.
Acidulated water consisting of:
Distilled water 100 c.c.
Hydrochloric acid U. S. P. 1.25 } .... 154 c.c.

The eggs are to be boiled for 15 minutes and the whites pressed (by means of a spatula) through a (preferably flat) 30 mesh sieve. For the sake of uniformity, the egg whites should be cut into small pieces and thoroughly mixed before being passed through the sieve.

The mixture should be maintained at 100–105° F. for six hours, and agitated thoroughly about every half-hour.

At the end of six hours the temperature of the bath should be quickly run up above 145° F. to destroy the pepsin, then the bath with contained bottles allowed to remain undisturbed over night, that the undissolved albumen may settle.

If the test bottle has been kept securely corked during the test, or if by previously weighing bottle and contents and afterwards

making up with water any loss from evaporation, the quantity of albumen dissolved may be easily determined as follows :

From the settled contents of the test bottle pipette off 10 c.c. and evaporate to dryness—until weight is constant—in a watch glass. From this dry residue figure as follows (1 pt. of pepton or intermediate products representing 1 pt. of original albumen):

Suppose 10 c.c. of the liquid = 0.2 grm. dry residue ; $\frac{7}{1.4}$ times its weight = the quantity of water contained in the 10 c.c. that was derived from the albumen dissolved ; 10 c.c. of liquid less 1.4 c.c. of water leaves 8.6 c.c. water taken from the 154 c.c. of acidulated water in making the test.

1.6 grms. or 8 times 0.2 grm. dry residue = the quantity of albumen in its natural state as originally used, that has been dissolved in the 10 c.c. of liquid evaporated to dryness.

Therefore, if 8.6 c.c. acidulated water holds 1.6 grm. egg-albumen,
then 154 c.c. " " " 28.5 " "

Then, as 0.015 grm. pepsin dissolved 28.5 grms. coagulated egg-albumen, 1 pt. would dissolve 1900 times its weight.

The use of the multiplier 7 and 8 is based on the fact that egg-albumen averages 12½%, or ⅛ dry.

As will be seen, this test is quite a departure from the U. S. P. test, and in some respects is an improvement upon the latter, but I object to it on several points, viz.:

1. It makes no provision for other than concentrated, or, as Manwaring calls them, *pure* pepsins, while in reality the number of these is small compared to the saccharated pepsins.

A person desiring to assay a saccharated pepsin by this test, would be at an utter loss to know how much pepsin should be weighed out, or how much acidulated water should be employed, unless he knew that the pepsin under examination was of U. S. P. strength.

This cannot be ascertained without submitting the sample to a complete chemical analysis, and hence a great deal of trouble and erroneous results are apt to ensue.

I have encountered this very trouble myself, as may be seen from the following figures :

A sample of pepsin, purchased as a pure pepsin (pepsin C in the tables), but which in reality was a saccharated pepsin, gave by this

method 420, *i. e.*, it is supposed to dissolve 420 times its weight of coagulated albumen.

Not knowing the strength of this saccharated article in pepsin, I was at a loss to know how much should be used in the test, and therefore decided to look upon it as a concentrated pepsin. In consequence of this decision on my part the pepsin was saccharated according to M.'s directions, and 0.3 grm. of this resaccharated pepsin used in the test, with the above result. The result obtained undoubtedly does the pepsin injustice, for it is probable that if I had not resaccharated the original article, and consequently diluted it to a much greater extent, that a much higher test would have been recarded.

The same applies also to the following pepsins, which were in the saccharated condition when bought and were resaccharated by me before testing.

Brand of Pepsin.	Grs. Albumen dissolved in six hours.
Pepsin A	550.6
" B	516.6
" C	420.
" D	398.6

2. We are further instructed to raise the temperature of the mixture after six hours' digestion up to and above 145° F. to destroy the peptic principle, and then the bath, with contained bottles, is allowed to rest over night. It has been shown by numerous experiments that the peptic principle is not killed at this temperature (145° F. = 62.2° C.), but that on the contrary digestion may and does continue up to 80° C., though of course much more slowly than at a lower temperature. If, therefore, a bottle containing a quantity of undissolved albumen be subjected to a temperature of 62.2° C., and that only for a comparatively short time (or during the time that the water bath is cooling), it is manifest that the peptic principle would not be injured, and that consequently digestion will progress all night. We should thus obtain a much too high and an erroneous result.

3. The next step in the process is to pipette off 10 c. c. from the settled contents of the test bottle, and evaporate to constant weight. Although I have found that as a rule the undigested albumen remaining in the test bottle settles pretty well over night,

yet there is always a little left suspended in the liquid, which, if pipetted off, as it must be, would add to the weight of the dry residue obtained from the 10 c. c. pipetted off, and hence would be a new source of error.

4. We are next directed to evaporate the 10 c. c. to dryness, and in doing this the residue chars or carbonizes, owing to the free hydrochloric acid contained in the water, so that in reality we weigh a certain amount of carbonaceous matter, instead of peptone, etc. Does this represent the amount of coagulated albumen dissolved by the pepsin? It may, but I strongly doubt it.

5. Assuming that the dry residue had not charred, what would we then be weighing? We would be weighing a mixture consisting of undigested albumen, partially digested albumen, and fully digested albumen, or peptone, together with all the intermediary products which always are to be met with in peptic digestions. Does this represent the efficiency of the pepsin, or is it not more likely that the amount of true peptone formed is an indication of the strength of the pepsin? The latter, in my opinion, is the more plausible explanation, especially if it be remembered that only the peptone is assimilable in the human system, while the intermediary products are not. In short, if we let the weight of all the products formed in a peptic digestion represent the efficiency of a pepsin, we would be obtaining a result considerably above what it ought to be.

6. As far as the calculations involved in this test are concerned, I would say that they are very ingenious and eminently fitted to make a pepsin test as high as possible. I will not dispute the accuracy of the multipliers 7 and 8, but do not believe that their accuracy is infallible in every test.

As this test was particularly gotten up to determine the digestive power of concentrated pepsins, I therefore append tests made by myself upon two such pepsins.

Pepsin E.—One grain of this pepsin was found to digest 819.2 grains coagulated egg albumen in six hours.

Pepsin F.—One grain of this article was found to digest 784 grains of coagulated egg albumen in six hours.

I have found by personal experience that the accumulation of peptone during peptic digestions hinders and finally stops the

action of the pepsin upon the albuminoid matter entirely. If now the liquid be diluted, digestion will recommence again and proceed until the pepsin has become inert. (I do not believe in the theory that one grain of pepsin can go on digesting to infinity.)

As Manwaring lays particular stress upon this question of dilution, I think his test is a decided improvement over the U. S. P. test.

The next good point in his test lies in the fact that he does not attempt to weigh the undigested albumen, as is done in the U. S. P. test, and thereby does away with a great source of error; but instead of this he figures the amount of albumen (?) digested upon a dry basis, and then tries to convert this dry basis by calculation into albumen on the wet basis. In doing this errors are apt to occur, as I have already pointed out, but I do not think that they are errors of such magnitude as are apt to be obtained with the U. S. P. test.

Finally, I wish to say a few words about a test which I consider to be the only approach to an accurate method of testing pepsin that I know of. I do not claim that this test is absolutely accurate either, as slight errors are apt to occur, which, however, do not materially injure the final result. I refer to the Kremel test, which was published some time since in the Druggists' Circular.

In devising this test Kremel has made a radical departure from the usual methods, and bases his test upon the fact that under the conditions in which artificial peptic digestions take place, pepsin alone has the property of converting albuminoid matter into peptone, and that, therefore, from an analytical as well as from a physiological standpoint, the only correct method is to take the quantity of peptone produced as a gauge of the action of the pepsin; or in other words, the test is made to resemble as nearly as possible the conditions existing in the natural process.

Without going into any further detail, the test is made as follows:

One grm. of egg albumen (soluble) dried at 40° C. and pulverized, and 0.1 grm. of the pepsin to be tested, are placed into a 100 c.c. flask, and dissolved in 50 c.c. of 0.2 per cent. hydrochloric acid. The solution is heated to 38-40° C. for three hours, and then exactly neutralized with sodium carbonate; it is then

heated on a water bath to 90° C., and cooled after coagulation has taken place. The flask is then filled to the mark with distilled water, and 50 c. c. are filtered off and evaporated to dryness in a platinum dish on a water bath.

The residue is dissolved in hot distilled water, filtered through a moist filter into a platinum dish, and the filter carefully washed. The solution is again evaporated to dryness and weighed. The peptone is then incinerated with ammonium carbonate, and the weight of the ash deducted leaves the weight of the pure peptone, or the representative of the digestive power of the pepsin.

The good qualities of the above test are the following:

1. Simplicity.

2. No guesswork, troublesome calculations or the use of questionable factors.

3. No weighing of albumen dissolved in hydrochloric acid, undigested albumen and intermediary products along with the peptone. This is all obviated by the use of soluble egg albumen, coagulation and filtration or removal of the undigested portion as detailed above.

4. The ease with which it is possible to duplicate and still obtain concordant results.

On the other hand, the objections to this process are the following:

1. The great difficulty of procuring absolutely pure soluble dried egg albumen. This source of error, however, in my opinion, is very slight, because in each test a large excess of albumen is always used, and consequently the pepsin always has enough albumen to act upon. Besides this it must be remembered that only the peptone formed is weighed, and not the amount of undigested albumen, as is the case with the U. S. P. test.

2. It may be objected to this test that the results obtained are expressed by the weight of peptone formed and not by the weight of albumen dissolved, and consequently the figures, being based upon dry peptone, will be much lower than when the result is expressed as so much moist or coagulated albumen. If this, however, be objected to, it is comparatively easy to obtain higher figures by a simple calculation. Assuming that the amount of dry peptone obtained is equivalent to so much dry albumen, then by

multiplying the weight of the latter by 8 (Manwaring's multiplier) we would obtain the equivalent in coagulated or moist albumen. I do not think it necessary or advisable to follow this course, as it involves the use of a multiplier which, as already pointed out, is questionable.

3. It takes a little longer to make a test by this process, but if accuracy is thereby gained the process is to be preferred.

To further illustrate the test, I append the following results obtained with commercial pepsins:

		Peptone formed from 0.1 grm. pepsin in 8 hours.
Pepsin	G	0.5844
"	E	0.4972
"	B	0.4722
"	F, crystal	0.4682
"	C (saccharated)	0.4676
"	H	0.4598
"	A (saccharated ?)	0.4370
"	A (saccharated)	0.4246
"	D plain, soluble	0.3470
"	D pure, scales	0.3250
"	D pure, another sample	0.3146
"	I (saccharated)	0.2780
"	J French	0.1848
"	K (saccharated)	0.1738

These tests were all made with the same quantity of pepsin, whether the latter was saccharated or not, and I think are a fair indication of the relative values of the different pepsins.

It may be objected that this test does not do a concentrated pepsin full justice, on the ground that the latter would form a much greater proportion of peptone and thus retard if not completely arrest any further action of the pepsin upon the albuminoid matter.

In order to test this question, I saccharated samples of E, F and H respectively, according to Manwaring's directions, which is equivalent to diluting with mere acidulated water, and submitted them to the same conditions as before and obtained the following results:

		Peptone formed from 0.1 grm. pepsin in 8 hours.
Pepsin	E	0.2620
"	F	0.1240
"	H	0.1250

It will be observed that in these tests the figures are considerably lower than in the former ones; but it must be remembered that the pepsins with which the tests were made were twenty times weaker, or rather more diluted, than in the previous tests, and notwithstanding this the peptone formed is proportionally larger than before. This would clearly show that dilution is beneficial in the case of concentrated pepsins, as it corrects the retarding action of peptone. As the dilution in these last tests was twenty times greater than in the previous ones, we ought, by multiplying each of the above results by twenty, to obtain the amount of peptone which would be formed by using the pepsins in their concentrated forms, viz.:

	Peptone that should be formed from 0.1 grm. concentrated pepsin in 3 hours.
Pepsin E	5.240
" F	2.480
" H	2.500

The above figures are not, however, obtained as has already been shown, and therefore the calculation is erroneous.

As all the results obtained by strictly following Kremel's directions are comparable among themselves, I do not see how the process can well be improved upon.

The mere fact that increased dilution increases the yield of peptone is not, in my opinion, sufficient reason for condemning the process. As the conditions prevailing in the stomach of a full grown man do not differ materially as to dilution from day to day, it is safe to say that pepsins of varying strength administered to such a person will only perform a certain amount of work and no more, and that, consequently, the results obtained by this test more closely resemble the conditions prevailing inside the stomach than any other.

In conclusion, it will be seen that all the tests mentioned in this paper are subject to faults and imperfections, some having more than others; and, therefore, all we can do under the present unsatisfactory state of affairs is to select the one which is least objectionable, and this, in my opinion, is the Kremel test.

A NEW CONDENSER ATTACHMENT.

By Joseph F. Geisler.

The condenser attachment consists of a bulb shaped cylinder about 2½ inches in diameter, and 4 inches in length (exclusive of lower contracted portion to fit into the stopper of the percolator, containing the extraction tube), into the neck of which a tube (1 inch in diameter), containing a syphon, is attached by fusion. The tube reaches well down into the cylinder, and is perforated above the height of the syphon, to admit the vapors into the condenser. The inner end of the syphon reaches very near to the bottom of the tube, and thus will thoroughly drain the same. The condenser attachment, made for me by Eimer & Amend, delivers about 15 c.c. of solvent at each syphoning, which is the most suitable quantity for ordinary work. Any desired quantity of solvent can be delivered by increasing the size of the reception tube, or raising the height of the syphon, in which case the size of the extraction tube must also be increased, to hold the increased quantity of solvent. The solvent drops from the condenser into the bulb shaped attachment and is discharged periodically by the automatic syphon upon the substance contained in the extraction tube below. The condenser attachment is of special advantage in the extraction of crude drugs, fats, alkaloids, resins, or substances to be removed by volatile solvents, such as ether, petroleum ether, chloroform, etc. One objection to the ordinary extraction tube and percolator with condenser is, that the time of extraction is unnecessarily prolonged by the continual dilution of the solvent in the extraction tube by the condensed portions from the condenser, before that already in the extraction tube has had time to drain off. The difficulty is obviated by the condenser attachment, for little of the condensed solvent will get into the extraction tube proper until the reception tube is filled to the bend in the syphon, when the tube empties itself. By a little care this can so be regulated that the solvent in the extraction tube is drained off before a fresh

supply is syphoned into the same from the tube above. By keeping sufficient solvent in the lower flask or receiver, there is no danger whatever of the material in the extraction tube becoming overheated and ejecting the solvent, when the latter is delivered upon the same. The inner tube of the Liebig condenser, used with this piece of apparatus, should have an internal diameter of $\frac{5}{16}$, or better, $\frac{3}{8}$ inch, and the lower end should be cut off obliquely. The following are the sizes of the different parts of the complete extraction apparatus, convenient and suitable for the needs of ordinary work:

1. A 6 oz. Erlenmeyer flask.
2. Extraction tube, $1\frac{1}{8}$ inches (inter. diameter) $\times$ 5 inches length.
3. Percolator, $1\frac{1}{2}$ inches internal diameter, $\times$ 7 inches for body of cylinder, exclusive of lower contracted end of about $2\frac{1}{2}$ inches. Total length of percolater, $9\frac{1}{2}$ inches.
4. Condenser attachment, size to deliver about 15 c.c. solvent.
5. Liebig condenser, about 15–16 inches in total length, with inner tube of $\frac{5}{16}$ to $\frac{3}{8}$ inch internal diameter, and lower end cut off obliquely.

ABSTRACTS.

ANALYTICAL CHEMISTRY.

Analysis of German Silver. FELIX OETTEL.

This alloy of Cu, Ni and Zn, with occasionally Sn, Pb, Fe, Co, and Mn, is most readily analyzed as follows:

Dissolve the alloy in nitric acid and evaporate the solution, previously filtering if tin be present, and adding 15 to 20 drops of sulphuric acid for each .5 grm. metal taken. Separate the lead as sulphate if present. The filtrate, free from Sn and Pb, is diluted to 100 c.c., 2 c.c. of conc. hydrochloric acid are added, and the solution is treated with H_2S gas. On completion of the precipitate, indicated by the rapid settling of the CuS, heat to boiling, cool and filter. Wash the precipitate with dilute hydrochloric acid containing H_2S, and

complete the washing with very dilute hydrosulphuric acid. Determine the copper as sulphide.

Evaporate the filtrate from the above to remove the HCl, take up with water, neutralize with KOH solution, add a few drops of sodium acetate (1:10), and then saturate with H_2S. Determine the precipitated zinc as ZnS.

Evaporate the filtrate to remove H_2S, oxidize with bromine water, precipitate the iron as a hydrate by NH_4OH, and from the filtrate, made strongly alkaline with NH_4OH, precipitate the Ni and Co by electrolysis.

Manganese, if present, is determined as Mn_3O_4. To determine the copper by electrolysis dissolve 5 to 6 grms. of the alloy in nitric acid, add 5 c.c. conc. nitric acid, dilute to 100 c.c. and submit to electric current.

Two samples thus assayed yielded:

Cu	61.22	57.53
Ni and Co	12.77	15.57
Zn	24.41	25.46
Pb	0.16	0.42
Sn	0.00	0.25
Fe	1.54	0.66
Mn	trace	0.14
	100.10	100.03

(*Zeit. anal. Chem.*, **27**, *15*.) J. F. G.

Generation of Hydrosulphuric Acid—Generation of Pure Hydrosulphuric Acid. CLEMENS WINKLER.

The author recommends barium sulphide for this purpose. 100 pts. of heavy spar, 25 pts. of coal, and 20 pts. of NaCl, all finely pulverized, are thoroughly mixed, and formed into a heavy paste by the gradual addition of water during the stirring. The mass is packed into a crucible, dried, and then ignited for a few hours at almost a white heat; cool, and finally remove the mass, and break into convenient sizes by the blows of a hammer. The BaS should be preserved in a dry place in well stoppered bottles or tin capsules. The H_2S is liberated from the BaS preferably by dilute hydrochloric acid. (*Zeit. anal. Chem.*, **27**, *26*.) J. F. G.

Detection of Sodium Phosphate in Glacial Phosphoric Acid. ANTON BETTENDORFF.

At 12° C. 1 part of sodium chloride requires for complete solution 1348 parts by wt. of hydrochloric acid of 1.190 sp. gr. At ordinary temperatures the transposition between the hydrochloric acid and phosphoric acid of the sodium phosphate is complete. Hence the presence of sodium phosphate in glacial phosphoric acid is indicated by the separation of crystals of sodium chloride when the glac. phosphoric acid is dissolved in hydrochloric acid of 1.190 sp. gr. (*Zeit. anal. Chem.*, **27**, *24*.) J. F. G.

Determination of Alumina in presence of Ferric Oxide and Phosphoric Acid. L. BLUM.

The author calls attention to the fact that dilute solutions of ammonium chloride are decomposed on boiling, the solution becoming acid in reaction due to liberation of the hydrochloric acid. To fully precipitate the aluminium as $Al_2(OH)_6$ by the addition of ammonium hydrate it is advisable not to boil the solution to rid it of the excess of ammonia, but to add a slight excess of ammonium hydrate, heat to boiling and filter immediately. (*Zeit. anal. Chem.*, **27**, *19*.) J. F. G.

Determination of Arsenic in Pyrites. H. FRESENIUS.

Comparative determinations of the arsenic in pyrites showed that the fusion method (fusion with KNO_3 and $NaCO_3$, etc.), offers no advantage in point of accuracy over the direct distillation of the arsenic with ferric chloride, after the preliminary oxidation in a stream of chlorine gas or with hydrochloric acid and potassium chlorate. (*Zeit. anal. Chem.*, **27**, *34*.) J. F. G.

Estimation of Chromium in Iron and Steel. J. C. ARNOLD and HENRY J. HARDY.

Precipitation as hydrate is open to the objection that phosphorus is usually present in the oxide finally weighed. Under suitable conditions chromium may be readily obtained as a basic phosphate of invariable composition ($Cr_6P_4O_{19}$) and may be weighed as such.

The accuracy of the results depends upon rigid adherence to the details given. (*Chem. News*, **57**, *153*.) W. P. M.

Moisture Remaining in Gases dried by Means of P_2O_5. E. W. MORLEY.

Anhydrous phosphoric acid acts more thoroughly than concentrated sulphuric acid. It requires ten thousand litres of the dried gas to yield ¼ milligram of moisture, whereas this weight of moisture is contained in 100 litres of gas dessicated by means of sulphuric acid. (*Zeit. anal. Chem.*, **27**, *1.*) J. F. G.

A New Apparatus for the Direct Determination of Carbonic Acid. OSCAR OSTERSETZER.

This is a compact form of apparatus, in which the generated CO_2 is completely dried by passing through H_2SO_4, and further purified by passing through pumice stone saturated with $CuSO_4$, and finally absorbed in potassium hydrate solution and soda lime. With illustration. (*Zeit. anal. Chem.*, **27**, *27.*) J. F. G.

Gasometric Method of Determining Nitrous Acid. PERCY F. FRANKLAND.

The problem was to determine the nitrous acid present in a solution also containing nitrates, ammonia and organic matter. The quantity of nitrous acid present was too great to allow the use of any of the ordinary colorimetric methods, and the organic matter prevented the employment of standard permanganate.

Advantage was taken of the reaction between nitrous acid and urea:

$$2CO(NH_2)_2+2HNO_2=CO(NH_4O)_2+H_2O+CO_2+2N_2$$

and the calculation was based upon the volume of the evolved nitrogen. A tube, with cup and stopcock at one end similar to that of a Lunge's nitrometer was employed, and the introduction of the liquids was, as usual, made with aid of mercury.

An excess of crystallized urea was added to the residue left upon evaporation of the liquid under examination, 2 c.c. boiling water and the rinsings were added, and the solution was introduced into the tube. An excess of dilute H_2SO_4 (1 : 5), amounting to a few c.c., was then poured into the cup and admitted to the tube. An evolution of CO_2 and N followed. After 15 minutes, strong KHO solution was added and the mixture agitated until the CO_2 was absorbed. The volume of the remaining nitrogen was determined as usual.

In using this method it is always necessary, before beginning the evaporation of the original liquid, to add thereto a little strong KHO solution, as otherwise the salts of ammonium present would cause decomposition of the nitrites:

$$NH_4Cl + NaNO_2 = N_2 + NaCl + 2H_2O.$$

Where nitrites and nitrates are each to be determined separately, the author proposes to determine the nitrites as above, and then, in a new portion, destroy the nitrites by evaporating with an excess of NH_4Cl and estimate the nitrate in the residue by the mercury method. (*Jour. Chem. Soc.*, **53**, *364.*) W. P. M.

J. Wiborgh's Gas-Volumetric Method for Determination of Carbon in Iron and Steel. H. V. JÜPTNER.

This method depends on the oxidation of the carbon by chromic and sulphuric acids, and the subsequent volumetric estimation of the resulting CO_2. For reasons discussed at length, treatment with cupric sulphate precedes oxidation by the mixed acids.

To obtain correct results, it is necessary that the carbon should be completely oxidized to CO_2, to which end it must be observed that (1) during treatment of the iron with cupric sulphate no carbon shall be lost as hydrocarbons; (2) that during oxidation with the mixed acids no hydrocarbons, but only CO_2, shall be allowed to form; and (3) that complete solution shall be effected.

[Detailed descriptions of method and apparatus are given.] (*Berg. u. Huttenwesen*, **36**, *67.*) D. W.

Tiles for Combustion Furnace. A. W. STOKES.

In place of the easily broken tiles of fire clay, the author greatly prefers slabs of asbestos cardboard. It is lighter, does not break, radiates less heat and cools more rapidly. (*Chem. News*, **57**, *150.*) W. P. M.

New Method for Determination of Ash. LUDWIG REESE.

Into a difficultly fusible glass tube A B, 40–50 cm. long and 18–22 mm. internal diam. and connected with an aspirator, is placed a smaller glass "combustion tube" *a b*, 16–20 cm. long and 11–15 mm. inter. diam., having one end contracted and plugged with a double thickness of platinum gauze. A coil of platinum wire

wound around the tube *a b* prevents the adhesion of the latter to the outer tube during combustion.

The material to be incinerated, contained in a porcelain vessel, is placed in the "combustion tube," a current of air drawn through the "combustion tube" by means of the aspirator, and by the proper regulation of the flames of a series of burners under the tube A B the drying and combustion proceeds very rapidly. (*Zeit. anal. Chem.*, **27**, *133*.) J. F. G.

Use of Asbestos in Filtration. W. Fresenius.

To facilitate the recovery and filtration of precipitates in liquid containing finely suspended matter, especially in digestion experiments, dilute the liquid considerably with water, add finely divided asbestos fibre, thoroughly mix by shaking, set the whole aside to settle, and, when clear, decant the supernatant liquid. Wash by decantation, and for recovery of the precipitated matter filter the residuum through a plug of asbestos fibre in a glass funnel. (*Zeit. anal. Chem.*, **27**, *32*.) J. F. G.

Apparatus for Fat Extraction. O. Foerster.

The improvement in this apparatus is in the form of the extraction tube into which the material to be exhausted is packed. The extraction tube has a cylindrical form, with lower end contracted, and the outer surface greatly thickened at a number of points, so as to allow a free circulation of the volatile solvent between the surfaces of the extraction tube and the percolator in which it rests, thus doing away with strings or wire necessary to suspend the tube in the more common forms of repercolation apparatus. (*Zeit. anal. Chem.*, **27**, *30*.) J. F. G.

Pressure Tubes. H. N. Warren.

Glass combustion tubing (sealed at each end) is used as usual; the novelty being that the space between it and the outer (copper) tube is packed with magnesia. The whole is then immersed in a bath of melted lead. This arrangement is intended for temperatures ranging from 400° to 700° F.

For higher temperatures, as where a red heat is desired, the outer tube should be of wrought iron, and fine sand be substituted for the magnesia. (*Chem. News*, **57**, *155*.) W. P. M.

Pepper Adulteration and Analysis. F. M. RIMMINGTON.

An illustrated paper of interest from a microscopic standpoint only. The author holds that no purely chemical process can be relied upon to detect modern pepper adulterations. (*Analyst*, **13**, *81*.) W. P. M.

Contribution to the Examination of Spices. EUGEN BORGMANN.

About 1 grm. of the pulverized spice is shaken with about 10 c.c. of water and the mixture poured upon an unglazed porcelain surface. The water is rapidly absorbed and leaves the spice in a separated condition suitable for examination by a lens. (*Zeit. anal. Chem.*, **27**, *31*.)

Examination of Cod Liver Oil and Vegetable Oils. Prof. E. SALKOWSKI.

For determining the congealing and melting points fresh samples must be taken for each experiment. Of 11 cod liver oils tested all became turbid after 2½ to 3 hrs.; at —10 to —12°, all but 2 solid. Of the chilled oils placed in melting snow 6 became liquid (clear or slightly turbid) in 2 hrs., 5 remained solid. When the fresh oils, not previously chilled, were placed in snow 8 remained clear and liquid, 2 became turbid and thick and only one became solid.

By the Reichert-Meissel method 5 grms. of oil required from .1 to .2 c.c. of $\frac{n}{10}$ NaHO.

The peculiar color reactions with sulphuric acid (using the oil in chloroform solution) are due to the yellow coloring matter, cholesterin and the fatty acids of the oil. The first indigo blue developed by the action of the sulphuric acid is due to the yellow coloring matter which is characterized as a lipochrome. The yellow color can be extracted from the saponified oil by ether. Palm oil and the yolk of eggs contain it in large quantity, butter fat small amounts, cottonseed oil traces, and the other vegetable oils none.

The fatty acids of cod liver oil, freed from the yellow coloring matter, dissolved in 20 pts. of chloroform and treated with an equal volume of sulphuric acid, produce a deep brownish red mixture with a deep green reflection. To apply the test, decant the colorless chloroform after ½ hr. and pour a few drops of the sulphuric

acid in a few c.c. of glacial acetic acid. At first there is but little color developed, but on standing 1–2 hrs. a red violet color with a dirty green reflection results.

Cholesterin (melting point 146°) was found in each of the cod liver oils. Animal fats contain cholesterin, vegetable oils phytosterin.

The hot saturated alcoholic solution of cholesterin solidifies on cooling to a mass of crystalline plates which, under the microscope, appear as thin rhombic plates, frequently containing a re-entrant angle.

The phytosterin of vegetable oils, however, deposits from the hot alcoholic solution, in long needlelike crystals, arranged in star shaped bundles. If slowly crystallized the crystals may appear as elongated six-sided plates.

To separate cholesterin from cod liver oil take about 10 grms. of the oil and saponify with 10 grms. of KOH and 20 c.c. of dilute alcohol. After saponification dilute with water to about 600–700 c.c., shake with about 500 c.c. of ether, allow to separate, decant and evaporate the ether. The residue, if impure, is saponified with a little alcoholic potash and again extracted with ether. The ether solution is washed with water to remove any soap. Evaporate the ether, take up the residue with alcohol, concentrate to 1–2 c.c., allow to crystallize and determine the melting point of the purified crystals. A melting point of less than 146° would indicate the admixture of vegetable oil with the cod liver oil. (*Zeit. anal. Chem.*, **26**, *557.*) J. F. G.

INDUSTRIAL CHEMISTRY.

Free Carbonic Acid in Potable Water and its Effect on Leaden Pipes. E. Reichardt.

Experiments show that it is only water containing free carbonic acid that attacks lead pipes. The view that lead pipes conducting such water become encrusted gradually, and thereby capable of resisting corrosion, has yet to be proved. Observation shows that, except with hard waters holding much lime, there is no deposit in the lead pipes, even after years of use. A water containing free CO_2 and proportionally rich in alkaline carbonates, in a pipe used 300 years, has caused a deposit of phosphatic lead oxychloride scarcely ½ mm. thick, the pipe being in a good state of preserva-

tion. As to the occurrence of water containing free carbonic acid, different mountain springs usually do not contain more than that necessary for solution of the monocarbonate present, often scarcely sufficient to form bicarbonate, but sometimes more, especially in waters holding much lime in solution.

Experiments thus far show that these spring waters do not attack lead except to the extent of minutest traces.

As compared with the infrequent occurrence of free carbonic acid in spring waters, river waters much more frequently contain it, though in far smaller quantity. It has thus far been proven that waters containing bicarbonates either in very small or in considerable quantities, do not attack lead, and even free carbonic acid, in small quantities, is without effect in presence of much lime and magnesia. On the contrary, the less mineral content, or the "softer" a water is, the more readily is lead dissolved.

Distilled or carbonic acid free water dissolves lead slowly with separation of oxyhydrate; distilled water holding carbonic acid in solution dissolves lead in much larger quantity, with separation of basic lead carbonate, a separation which can be very complete.

Water, to be conducted through lead pipes, should, under all circumstances, be examined for free carbonic acid and the amount determined. Its action on lead plates should also be noted.

The method preferred for free carbonic acid is Pettenkofer's—by means of rosalic acid, with which a change of color is produced not interfered with by simple or bi-carbonates.

Pettenkofer recommends 1 part rosalic acid in 500 parts alcohol, adding baryta water until the solution acquires a red tinge. In proportion to the quantity of free carbonic acid present this solution loses its color or becomes yellow. If carbonates only are present the color becomes red to violet, and this is easily observable and determinable by neutralizing the free carbonic acid to the point where bicarbonate is formed.

It has been found that water containing free carbonic acid loses its solvent action on lead as soon as the formation of bicarbonate is effected; even with distilled water this takes place when the free carbonic acid has been neutralized by soda to bicarbonate.

1 cc. rosalic acid to 1 litre of water has been used in all experiments. (*Archiv. de Pharm.*, **14**, *1049.*) D. W.

Abstracts of American Patents Relating to Chemistry.

(*From the Official Bulletin of the U. S. Patent Office.*)

February 21st, 1888.

378,095.—Apparatus for the manufacture of gas. A. C. Humphreys.

378,113.—Process of refining cotton seed oil. G. W. Scollay.

The oil is treated with a metallic chloride and an alkali.

378,114.—Process of refining cotton seed oil. G. W. Scollay.

The oil is treated with ochre and an alkali.

378,136.—Process of producing aluminum. J. S. Howard and F. M. Hill.

The ore is boiled with hydrochloric acid, and, after cooling, mixed with Spanish white or lime. The free acid is then evaporated off, and the mass heated to about 600° to volatilize the ferric chloride. The resulting product is charged in a lime lined crucible mixed with lime, charcoal, fluorspar, cryolite and sodium bisulphate, and the charge covered with stannous chloride and sodium chloride. The alloy produced is removed and melted in lead or bismuth, the aluminium and impurities skimmed off, and purified by heating on a bed of porous material.

378,230.—Process of treating liquids in evaporating pans. P. Casamajor.

378,231.—Process of treating cinchona bark. P. Casamajor.

The ground bark is separately treated with an acid and an alkali. The resulting solutions are mixed and the precipitate separated.

378,232.—Process of treating saccharine solutions. P. Casamajor.

378,233.—Treatment of cinchona bark. P. Casamajor.

The process consists in treating the barks successively with an acid, and with an alkali or alkaline carbonate, then precipitating the acids from the alkaline solution, and the alkaloids from the acid solution, and mixing the precipitates.

378,246.—Refining Canadian and similar petroleum oils. H. Frasch.

The oil is distilled with oxide of lead.

378,278.—Combining metals with aluminum. W. A. Baldwin.

378,326.—Apparatus for mingling and combining gases. A. C. Lewis.

February 28th, 1888.

378,490.—Process of manufacturing water gas. R. Boeklen.

378,583.—Insecticide. F. Fenstel.

An antiphylloxera consisting of tannic acid, ammonium sulphate, and potassium silicate.

378,673.—Apparatus for making sulphurous acid. C. E. Getchell.

378,681.—Apparatus for bleaching by electrolysis. E. Hermite and C. F. Cooper.

378,684.—Apparatus for manufacturing salt. H. A. Hogel and O. L. F. Browne.

378,774.—Process of treating sludge acid. H. de Grousilliers.

After floating off the petroleum and tarry impurities, sodium or potassium sulphate is added to the sludge acid. The resulting bisulphate is then dried and distilled.

March 6th, 1888.

378,940.—Apparatus for manufacturing gaseous fuel or illuminating gas. E. H. Shaw.

379,021.—Process of preparing glue stock. T. P. Milligan.

379,084.—Method of preparing and treating starch. J. C. Schuman.

379,090.—Process of refining oil. R. J. Wilson.

Intensely heated air is forced through the oil, and after the greater portion of the volatilized oil has been separated from the air, the air and uncondensed gases are utilized for illuminating or heating purposes.

379,150.—Dyeing animal textile fabrics with naphthazarin. R. Bohn.

The fabrics are treated with a chromium mordant and then dyed.

W. R.

JOURNAL

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The Journal of the American Chemical Society appears monthly, except during July and August. It will contain all papers read before the Society, as well as abstracts from American and Foreign Journals, and a list of American Patents relating to Chemical Industries.

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A. A. BRENEMAN, 97 Water St., New York.

ABSTRACTS.

GENERAL AND INORGANIC CHEMISTRY.

Curious Association of Hydrocarbons with Rock Salt in Nature. F. M. Lyte.

The frequent association of salt and bitumen or petroleum in the same deposits, has often struck me as likely to lead to the development of some probable theory as to the formation of these hydrocarbons.

Almost all specimens of rock salt, when struck or rubbed, give off more or less the characteristic odor of bitumen. Beds of rock salt are often colored brown by the bitumen they contain, and petroleum, on its emergence is nearly always associated with brine.

Deposits of rock salt are, as a rule, dry and anhydrous, though salt itself has a considerable attraction for moisture.

But more than this, those salts of potassium and magnesium, often occurring with it, are still more greedy of water.

If the seemingly probable theory that all formations of rock salt are due to the evaporation of sea water be correct, then these deliquescent and hygrometric chlorides would almost always have been the last part deposited in every bed of rock salt, and though owing to their great solubility, they may have been denuded and washed or melted away perhaps long afterwards, it is probable that they generally formed the final layer at first. These would, by their affinity for water, both during their formation and subsequently, tend to withdraw that liquid from all surrounding substances.

Now, most organic matter may be looked upon as a hydrocarbon combined with the elements of water. Withdraw the water and the hydrocarbon remains.

Metallic iron, if present, might modify the reaction. Is it not, then, a probable theory that most natural deposits of hydrocarbons

owe their origin to this absorption of water, acting through the lapse of ages on organic matter, often aided by heat and pressure? If such be admitted it would account for the frequent association of salt with hydrocarbons. (*Chem. News*, **58**, *87*.) W. P. M.

On a few Crystallized Seleniates. L. MICHEL.

The author has realized the preparations of several seleniates by the dry process and by double decomposition.

The chloride of the metal to be combined with selenic acid is melted with sodium seleniate; the melted mass is cooled slowly and then treated with water.

Barium Seleniate.—If to the mixture of sodium seleniate and barium chloride some sodium chloride is added large crystals are obtained. The sp. gr. is 4.45. The crystals are insoluble in water and in cold and strong nitric acid. HCl dissolves them when warm with evolution of Cl. The analysis gives:

S_2O_3	45.23
(BaO)	54.42 *
	99.65

The crystals are rectangular octaedra, belonging to the system of the right prism with rhomboidal base; the optical properties observed were similar to those of the natural barytine. (*Bul. Soc. Chim.*, **49**, *29*.) M. L.

On a New Oxacid of Sulphur. M. VILLIERS.

The author has studied the compounds resulting from the action of SO_2 on the hyposulphites and describes one of these compounds in this paper; the others he proposes to study later.

A current of SO_2 is made to pass into a flask containing crystals of sodium hyposulphite with a small portion of water cooled by ice water; the gas is passed till no absorption occurs. If crystals remain undissolved more water is added and the current of SO_2 kept up. The liquid is allowed to stand two or three days, and then it absorbs SO_2 again. The liquid is evaporated in vacuo and the crystals formed correspond to the composition S_4O_8Na. *

* O=8.

Dissolved in water they become $S_4O_8NaH_2O_2$. (*Bul. Soc. Chim.*, **49**, *671.*) M. L.

Preparation of Hydriodic Acid. A. ETARD.

The author describes an apparatus by which iodine can be introduced by fractions into a mixture of phosphorus and water. It consists of a small glass balloon having the neck bent and joined to a bent tube passing through the cork of a large balloon in which the reaction occurs: The joint between the tube and the neck of the iodine reservoir is a rubber ring; rotation of the iodine vessel permits the haloid to fall into the water. According to Lothar Meyer the production of PH_4I, together with HI, is prevented by introducing the phosphorus into the water mixed with iodine in excess. In the latter case the phosphorus must be placed in the rotating flask. (*Bul. Soc. Chim.*, **49**, *743.*) M. L.

On a New Double Carbonate of Potassium and Sodium. L. HUGOUNENG and J. MOREL.

The authors have obtained a new salt by evaporating slowly at 12° or 15° a solution of sodium carbonate containing potassium carbonate, in presence of an excess of potassium iodide mixed with sodium phosphate and sodium chloride. The mother liquor taken during crystallization contained per litre:

Potassium iodide	495.86	grms.
Potassium carbonate	10.34	"
Sodium carbonate	177.30	
Disodic phosphate	42.00	"
Sodium chloride	58.30	"

The analysis of the crystals produced answers to the formula,

$$CO_3KNa.6H_2O+CO_3Na_26H_2O.$$

Crystallographic determinations are given. (*Bul. Soc. Chim.* **49**, *740.*) M. L.

On the Toxic Character of Bismuth. DALCHÉ AND VILLEJEAN.

The authors state that bismuth although given in large quantities has never been observed to be toxic, but they assume that it is because the metal is not absorbed.

They have secured its absorption by hypodermic injection and have observed phenomena similar to those of mercurial poisoning, *e.g.* abundant salivation, disturbance of the renal functions, the urine becoming black and depositing a sediment containing bismuth; there is also development of enteritis with diarrhœa.

Bismuth applied upon wounds produces similar effects. (*Arch. de Pharm.*, **2**, *56.*) M. L.

Influence of Temperature on the Composition of Hydrated Calcium Sulphate. W. A. SHENSTONE and J. T. CUNDALL.

Both in dry and moist air, this salt is less stable than has been supposed. Experiment shows that the rate of dissociation is a slow one, but that it is much slower in its earlier stages than afterwards. One specimen of powdered selenite heated to 100° C. lost only .07% in weight at the end of 6 hours; beyond that time, however, the rate of loss was very greatly increased.

The experiments did not afford support to the idea that hydrates of calcium sulphate exist other than $CaSO_4 . 2H_2O$. (*J. Chem. Soc.*, **53**, *544.*) W. P. M.

Electrolytic Method of Liquefying Gases. H. N. WARREN.

A glass combustion bent at right angles, closed at each end, and having platinum plates fused into one extremity, is used. For the preparation of liquid HCl, for instance, a strong solution of the acid is introduced into the plate end of the tube, and the remaining limb is plunged into freezing mixture. Upon connection with a battery, the evolved gas liquefies in the cool end. (*Chem. News*, **58**, *127.*) W. P. M.

On a Fermentable Carbohydrate. E. GRIMAUX.

The author had in view the application of the Gorup-Besanez process of oxidation of mannite to glycerine by platinum black, with the purpose of obtaining glycerine aldehyde, $C_3H_6O_3$, and its transformation into a fermentable glucose, or even to attempt its direct fermentation. His conclusions are: that oxidized gly-

cerine gives glyceric aldehyde susceptible of alcoholic fermentation. He insists, 1st, that it is the first example of the synthesis of a fermentable sugar, having the same general reactions as glucoses, and 2d, that the definition of fermentable sugar must be modified, as they are not necessarily hydrates of carbon, containing C_6 or C_{12}. (*Bul. Soc. Chim.*, **49**, *251.*) M. L.

ABSTRACTS.

ORGANIC CHEMISTRY.

On the Sugars of Hesperidine and Isohesperidine. C. TANRET.

The author has found in the peel of bitter orange, besides hesperidine, another crystallized principle having 5 more mols. of water, which he calls isohesperidine. The object of this note is the study of the sugars yielded by the decomposition of these two glucosides. These glucosides give by decomposition a mixture of glucose and isodulcite in the proportion of 2:1. The quantity of sugar yielded was from 50 to 55 per cent. of the glucoside employed. The other product of decomposition, the so-called *hesperitine* has the formula $C_{32}H_{14}O_{12}$, (Hoffmann, Tiermann, Will), and the hesperetine of the two above cited glucosides melts at 222°. The author, finding that the decomposition is produced with fixation of water, proposes to change the formula of these glucosides. Instead of $C_{44}H_{26}O_{24}$ it would be $C_{100}H_{60}O_{54}$ (hesperidine) $C_{100}H_{60}O_{54}(H_2O_2)_5$ (isohesperidine,) and the équation of decomposition is

$$\underset{\text{hesperidine}}{C_{100}H_{60}O_{54}}+3H_2O_2=\underset{\text{hesperetine}}{(C_{32}H_{14}O_{12})_2}+\underset{\text{glucose}}{(C_{12}H_{12}O_{12})_2}+\underset{\text{isodulcite.}}{C_{12}H_{14}O_{12}} \;*$$

(*Bul. Soc. Chim.*, **49**, *23.*) M. L.

* O=8.

Researches on the Optical Isomeres of Cinchonine. E. JUNGFLEISCH and F. LEGER.

The authors recall the experiments of Pasteur in 1853 on the optical transformation of cinchonine into quinine by heat, for which fact the explanation was that these bodies must have a complete molecule formed by two active bodies, one of which rotates light to the right the other a little to the left; the result of the heating is to make one of the groups predominate, the other having been made inactive under the given conditions. The authors had in view the study of the great number of isomeres of the alkaloids of cinchona bark, Pasteur having only indicated one isomere for each group of alkaloid. They publish now their results on cinchonine.

This alkaloid was boiled with a solution of four parts of H_2SO_4, diluted with its weight of water, for 48 hours at 120°. The processes used for the separation of the alkaloid are too long to be described here. The bases separated and studied are:

1. *Cinchonibine*, $C_{38}H_{22}N_2O_2$. Insol. in ether, crystallizing in boiling alcohol; $\alpha D = +75°8$, in alcoholic solution of 0.75%.

2. *Chinchonifine*, $C_{38}H_{22}N_2O_2$. Insol. in ether, crystalling from boiling alcohol in needles, forming a very soluble succinate, $\alpha D = +195_0$, in alcoholic sol. of 0.75%.

3. *Cinchonigine*, $C_{38}H_{22}N_2O_2$. Sol. in ether, the hydrochloride very sparingly soluble in the cold, and crystallizing very well. $\alpha D = -60°1$ in alcoholic sol. of 1%.

4. *Cinchoniline*, $C_{38}H_{22}N_2O_2$. Sol. in ether, the hydrochloride in very large crystals, very soluble, the dihydriodide insoluble. $\alpha D = +53°2$ in alcoholic sol. of 1%.

The authors have found also two bases of another group:

5. *Oxycinchonine*, α $C_{38}H_{22}N_2O_4$. Insol. in ether, soluble in dilute alcohol; forming very sparingly soluble hydracid salts. $\alpha D = +182.56$ in alcoholic sol. of 1%.

6. *Oxycinchonine*, β $C_{38}H_{22}N_2O_4$. Insol. in ether, soluble in dilute alcohol, forming very soluble hydracid salts and a succinate very little soluble in cold. $\alpha D = +187.14$ in alcoholic sol. of 1%.

The separation of these products is described at length. (*Bul. Soc. Chim.*, **49**, *743*.) M. L.

Preparation of Tetraphenylethylene. P. DE BOISSIEU.

Dry distillation of diphenylmethane yields the above substance. The diphenylmethane, prepared by the action of benzyl chloride on benzol in presence of aluminum chloride is introduced into a balloon with a reflux condenser. The balloon carries a bromine funnel, and the bromine enters drop by drop. The operation goes on at about 150° ; when all the bromine has been added the temperature is raised to the boiling point, and kept till HBr is all driven off. The contents of the flask are introduced into a retort and distilled. The substance passing over above 360° has the properties of tetraphenylethylene as given by M. A. Behr. Nascent converts it into tetraphenylethane, whereas oxidation by chromic acid yields benzopinacone,

$$\begin{array}{r}(C_6H_5)_2{=}COH\\ | \\ (C_6H_5)_2{=}COH\end{array}$$

and then benzophenone. (*Bul. Soc. Chim.*, **49**, *681.*) M. L.

Preparation of Isoproprylacetrylenol with Methylisopropyl carbonyl. A. BEHAL.

The author had in view the study of the place of H taken by substitution in ethylene bromide, iodide or chloride. Two cases are to be considered. 1st. The bisubstituted body corresponds to an acetone, and has, near by, a tertiary carbon :

$$\begin{array}{l}R\\R\end{array}\!\!>CH-CCl_2-CH_3$$

2d. The derivative is such that one of the haloids is attached to a tertiary carbon, the other to a C group retaining one H :

$$\begin{array}{l}R\\R\end{array}\!\!>\begin{array}{l}C-CH-CH_3\\ |\quad\;\; | \\ Br{-}{-}Br\end{array}$$

The author considers the first case. He has taken methylisopropyl carbonyl

$$\begin{array}{l}CH_3\\CH_3\end{array}\!\!>CH-CO-CH_3$$

of which he indicates the preparation by the action of isobutyryl chloride on zinc methyl; the acetone obtained boils at 93–96°. This

body is treated with phosphorus perchloride, and the chloro-compound treated in sealed tubes with alcoholic potash. The properties of the body lead to the formula

$$\left.\begin{array}{l}CH_3\\CH_3\end{array}\right\rangle CH.-CH.$$

(*Bul. Soc. Chim.*, **49**, *23.*) M. L.

On the Metapyrazolones of Pinner and Lifschutz.

E. GRIMAUX.

MM. Pinner and Lifschütz have given the name of metapyrazolones to the bodies produced by the action of HCl on the combinations of urea with the cyanhydrines of aldehydes. According to those authors there would be formed the acid

$$R—CH\left\langle\begin{array}{l}CO_2H\\NH—CO—NH_2\end{array}\right.$$

which acid losing water will give

$$\left.\begin{array}{l}R—CH—CO\\ \quad\ \ |\\ \quad NH—CO\end{array}\right\rangle NH$$

R being an hydrocarbon radical, these bodies would be substituted products of metapyrazolone.

$$\left.\begin{array}{l}CH_2—CO\\ \ \ |\\ NH—CO\end{array}\right\rangle NH.$$

The authors, says M. Grimaux, thought that they had discovered a new function, for which they created a name. The pretended metapyrazolone is nothing but *hydantoine* or *glycolylurea.*

$$\left.\begin{array}{l}CH_2—NH\\ \ \ |\\ CO—NH\end{array}\right\rangle CO.$$

In the same way the author denies the necessity of accepting the name of metapyrazols, isomeres of metapyrazolones. (*Bul. Soc. Chim.*, **49**, *739.*) M. L.

Researches on Sulfines. G. PATEIN.

The author describes the preparation of these bodies by mixture of the theoretical quantities of the alcoholic sulphide and iodide;

the reaction is complete after two or three days without heating. The author has prepared—1. $(CH_3)_3$ SI. 2. $(C_2H_5)_3SI$.

$$3.\ \left.\begin{matrix}(C_2H_5)_2\\(CH_3)\end{matrix}\right\}SI.\quad 4.\ \left.\begin{matrix}(CH_3)_2\\(C_2H_5)\end{matrix}\right\}SI.$$

He has also prepared these bodies by another reaction, that of an alcoholic iodide on an alcoholic solution of sodium sulphide. He thinks that the reaction occurs thus: $3(CH_3)I+Na_2S=2\ NaI+(CH_3)_3SI$. $2(CH_3)_3SI+Na_2S=2NaI+3(CH_3)_2S$. By the reaction of these iodides of sulfines with silver cyanide he obtains the sulfine cyanines $(C_2H_5)_3SCN$. AgCN; $CH_3(C_2H_5)_2$ SCN. AgCN and the methyl compounds and ethyl-methyl compounds of identical composition. (*Bul. Soc. Chim.*, **49**, *678.*) M. L.

Hydration of Tolane. A. BEHAL.

Tolane or diphenylacetyn is, like phenanthrene, isomeric with anthracene. It answers to the composition $C_6H_5.C{=}C.C_6H_5$. The author has studied its hydration by means of sulphuric acid, with the intention of extending the reaction to the aromatic series. He describes his method as follows : The substance after distillation in a current of steam and crystallization from alcohol appears in lamellae, melting at 54–55°. The melting point compared with the analysis points to the presence of desoxybenzoin, that is an acetone phenylbenzyl carbonyl, $C_6H_5CO—CH_2C_6H_5$. (*Bul. Soc. Chim.*, **49**, *337.*) M. L.

Action of Sulphuric Acid on Cinchonine in Presence of Oxalic Acid. E. CAVENTON AND CH. GIRARD.

When cinchonine is submitted for several days to the action of oxalic acid in presence of H_2SO_4 between 125° and 130° the alkaloid is modified. The solution is precipitated by NH_3, and the precipitate treated by ether, which dissolves only a portion of it. The ethereal solution is agitated with acidulated water, the aqueous solution is precipitated by NH_3 and the precipitate is treated with benzole. The authors describe one of the two bases soluble in ether and benzol. It is also soluble in

acetone, chloroform, methyl, ethyl and amyl alcohols; it fuses at 125°, turns the plane of polarized light to the left, is sparingly soluble in water, and does not seem to be altered by ebullition. Heated with potash it gives compound ammonias, quinoleic and pyridic derivatives. It forms with HCl a well crystallized salt, soluble in water; with platinic chloride it gives a fine orange yellow precipitate. The composition is similar to that of cinchonine. (*Bul. Soc. Chim.*, **49**, *88*.) M. L.

Chemical Actions of some Micro-organisms. R. WARINGTON.

The action of twenty-seven varieties has been studied in four particulars:

1. The hydrolysis of urea.
2. Action on milk.
3. Capacity for reducing nitrates.
4. Power of producing nitrification.

The article is a long and full one. (*J. Chem. Soc.*, **53**, *727*.)
W. P. M.

ABSTRACTS.

ANALYTICAL CHEMISTRY.

Two New Methods for Estimation of Sulphur in Steel. J. O. ARNOLD and H. J. HARDY.

The first is intended for rapid (less than thirty minutes) and approximate determinations (error .01 to .03 per cent.) suited to quick, rough work, and consists in treating the borings with zinc and sulphuric acid (see cut in original article), absorbing the evolved H_2S in solution of NaHO, adding lead acetate and comparing the resulting coloration with one of known strength.

In the second method (which is of much greater accuracy) the borings are treated with sulphuric acid as before, but hydrogen is

supplied from a gas holder. The gases pass through a series of small test-tube-like vessels of special arrangement, each containing an amount of lead acetate solution sufficient to fix as sulphide .01% of S. in 2 grms. of steel. The reaction is self indicating. All that is required is to count the number of precipitated cylinders and estimate roughly the faint color in the last tube acted upon.

The article is fully illustrated. (*Chem. News*, 58, *41*.)

W. P. M.

Notes on the Manufacture of Chlorine, with Special Reference to the use of Magnesia in that Process, and its Economy. C. T. KINGZETT.

The chemical reactions that are concerned in the Weldon-Pechiney process are experimentally investigated and found to be:

1. $H_2O+MgCl_2=MgO+2HCl$
   $2HCl+O=H_2O+Cl_2$
2. $MgCl_2+O=MgO+Cl_2$

The decomposition of HCl vapor at a red heat by means of air is promoted by the presence of free magnesia. The author experimentally shows the possibility of using a constant and limited quantity of magnesia with a view of manufacturing chlorine from successive quantities of hydrochloric acid. He suggests the use of a substance such as brick or pumice stone, which has been previously coated or admixed with MgO or some magnesium salt, thus disposing of the great quantities of solid material handled in the Weldon-Pechiney process. (*J. Soc. Chem. Ind.*, 7, *286*.)

W. P. M.

Estimation of Nitrites, alone or in presence of Nitrates and Chlorides. T. CUTHBERT DAY.

The solution containing the nitrite is introduced into a flask of about 75 c.c. capacity and an excess of solid NH_4Cl added until the solution is *thoroughly* saturated.

From a suitable apparatus, pure CO_2 is passed into the flask until the atmosphere therein is entirely displaced. The contents of the flask are then boiled, and the evolved gases (CO_2 and N) pass by a delivery tube into a graduated absorption tube inverted over a

mercury bath, and containing mercury and a few c.c. of strong KHO solution. After complete reaction, the absorption tube is removed to a vessel full of water, the mercury allowed to fall out, and the volume of residual nitrogen measured after standing a few hours.

From the following equation it will be seen that the volume of nitrogen obtained must be *halved* in order to calculate the quantity of nitrite originally present:

$$KNO_2 + NH_4Cl = KCl + 2H_2O + N_2.$$

The presence of a nitrate does not affect the accuracy of the determination. (*J. Chem. Soc.*, **53**, *422*.) W. P. M.

Photochemical Estimation of Graded Tint. E. J. MILLS and J. BUCHANAN.

Attention has been directed to the comparison of tinctorial effect upon dyed goods. The process consists in photographing on an isochromatic plate, and at one operation, equal sized pieces of tissue, exhibiting different degrees of the same tint. A negative is thus obtained from which any number of prints can be produced on "gelatino-bromide" paper, and each impression represents definitely in terms of silver, the original grade of tint. All that is necessary is to make a sufficient number of impressions to enable the silver to be determined either volumetrically or gravimetrically. (*J. Soc. Chem. Ind.*, **7**, *309*.)

W. P. M.

Adulteration of Tallow with Cottonseed Oil. ROWLAND WILLIAMS.

The author shows that as much as 40 per cent. of the adulterant may be added without fear of detection by ordinary observation, and that determinations of the melting point and saponification equivalent are worthless, unless taken in conjunction with other data.

The equivalent of iodine absorption is, however, so different for tallow and cottonseed oil, that the author recommends it as a means of detecting admixture.

A five per cent. addition of cottonseed oil is readily noted. (*J. Soc. Chem. Ind.*, **7**, *186*.) W. P. M.

Detections of Falsification in Butter. P. BOCKAIRY.

The process is based upon the difference in quantities of alcohol necessary to precipitate the fatty matter, butter or other fat, in solution in crystallizable benzol. Of all fats examined pure butter is the one requiring the largest amount of alcohol before giving any precipitate. The author observes also the volume of the fatty matter precipitated, its physical appearance, etc., these appearances being different for every kind of fat observed by him. (*Bul. Soc. Chim.*, **49**, *247.*) M. L.

Alcoholic Silver Nitrate as a Reagent for Acetylene Hydrocarbons. A. BEHAL.

The author has found that the two reagents employed to characterize anacetylene hydrocarbons, viz., ammoniacal cupric chloride and ammoniacal silver nitrate, do not always indicate the presence of these even when abundant in a mixture. A proportion of 20 per cent. of œnanthylidene was not detected by silver nitrate, and a proportion of 10 per cent. was only doubtfully indicated by the cupric chloride. The author thinks that he has found a better reagent in an alcohol at 95° saturated with silver nitrate (the ammoniacal alcoholic solution does not give good results). He has observed precipitations with acetylene, allylene, œnanthylidene, caprylidene, dipropargyl, but not with the substituted acetylene hydrocarbons, ethylpropylacetylene, caprylidene of caprylene, or tolane. (*Bul. Soc. Chim.*, **49**, *335.*) M. L.

Determination of Starch in the Potato. A. GIRARD.

The author's researches have led him to conclude that 1 grain of starch of potato distended by certain reagents can absorb 0.122 iodine. On this fact he bases his process of determination. About two kilogs. of potatoesare taken in slices of 300 or 400 grms., grated, and 25 grms. of the pulp are placed in a 750 c.c. flask with 50 c.c. of HCl of $\frac{2}{1000}$ and left in contact for three hours. An ammoniacal solution of copper oxide is then added in the proportion of 100 c.c. and the solutions are left together over night ; the next day the solution is treated with excess of acetic acid. The iodine

solution is made with 3.05 grms. c.p. iodine and 4 gr. c.p. KI, 10 c.c. answer to 0.25 grms. starch. The operation is at end when a drop of the solution stains starch paper.

It is necessary to make a correction of 0.5 per cent. for albuminoid bodies. (*C. R., 1887,* **104,** *1629.*) M. L.

Detection of Saccharin in Beer. A. H. ALLEN.

Concentrate the beer to one-third. Agitate with ether. Evaporate the ethereal solution to dryness. Ignite the residue with caustic or carbonated alkali, also adding a little nitre. A sulphate will be formed by the ignition, which, of course, will give the usual precipitate with barium chloride. The weight of $BaSO_4$ precipitated, multiplied by .785 will give the weight of saccharin to which it corresponds. The concentrated beer should react acid before agitating with ether, therefore, if necessary, add a little phosphoric acid. (*Analyst,* **13,** *105.*) W. P. M.

New Process for the Medico-Legal Detection of Blood. M. TERRY DE LA BELLONE.

The suspected spots are put in contact with a $\frac{1}{1000}$ solution of NaCl, and the solution (after contact with the spots for several hours) is examined with the spectroscope for a haemoglobine. The solution is then treated with a few drops of a concentrated sol. of chloral. If a precipitate forms, a portion is taken on a piece of glass and coagulated by slight heat ; the liquid that separates is removed with filtering paper. The coagulum is treated with a sol. of fuchsine, washed with water to take away the excess of fuchsine, treated with a drop of acetic acid, covered with a slide and the blood globules are examined under the microscope. The author indicates modifications of the process for blood stains on wood, iron, earth, etc. (*Arch. de Pharm.,* **3,** *115.*) M. L.

Spectroscopic Detection of Blood. G. LUCOSSIER.

The author asserts that it is not the oxyhaemoglobine that give the most sensitive spectral reaction, but the reduced hematine (haemochromogene of Hoppe-Seyler). In other words, if an oxy-

haemoglobine solution will not give any absorption of light, the same solution will give a very distinct spectral reaction by being transformed into reduced haematine.

1. The blood spot is dissolved in water and oxyhaemoglobine is looked for with the spectroscope.

2. The solution is mixed with one drop of a fresh sol. of sodium hydrosulphite, which dispels the spectrum of oxyhaemoglobine.

3. One or two drops of a concentrated sol. of soda are added, haemoglobine break into globuline and reduced haematine. The author indicates as the spectral characteristics of the haematine, disappearance of the bands by heating to 50°, etc., etc. (*Bul. Soc. Chim.*, **49**, *691*.) M. L.

ABSTRACTS.

INDUSTRIAL CHEMISTRY.

Experiments on the Industrial Value of Thompson's Calorimeter. M. SCHEURER-KESTNER.

The apparatus is used in England for the determination of the heat of combustion of coal, etc., the matter being mixed with eight or ten times its weight of a mixture of potassium chlorate and potassium nitrate. The author finds that this quantity of oxidizing agent is too small and he employs from 11 to 14 times the weight of the combustible. The author compared this instrument with the calorimeter of Fabre and Silbermann, employing charcoal, and the result is that the figures obtained with Thompson's instrument must be increased by 15 per cent. Applying this correction the instrument gives sufficiently good results. With practice the error does not reach 1 per cent., although the results cannot be absolutely depended upon, the author having met anomalies in results that he is at a loss to explain. (*Bul. Soc. Chim.*, **49**, *685*.) M. L.

Rate at which Bleaching Powder loses its Available Chlorine. JOHN PATTINSON.

Samples of the same powder were kept at the several temperatures of 60°, 70° and 80° F. and were analyzed monthly for a period of twelve months. The original samples contained 36.10 per cent. available chlorine. At the end of a year the results were :

	Original.	60°.	70°.	80°.
Available Chlorine	36.10	30.10	28.30	19.10
Chlorine as Chloride	0.14	5.37	6.91	15.17
Total Chlorine	36.33	35.47	35.64	35.64

Thus the available chlorine disappears in proportion to the length of time the powder is kept, and to the degree of temperature. The total chlorine remaining nearly constant, the change is probably :

$$CaOCl_2 = CaCl_2 + O.$$

(*J. Soc. Chem. Ind.*, 7, *188.*) W. P. M.

Recovery of Sulphur from Alkali Waste. A. M. CHANCE.

The mixture of alkali waste and water, of the consistency of thin cream, is placed in a series of vessels (see illustration in original article) and lime kiln gases (CO_2 and N) then forced through.

Calcium sulphide is broken up by the CO_2, with liberation of H_2S, which passes on to the next vessel, where it meets with a further quantity of alkali waste, and is absorbed with production of CaH_2S_2. For a time, the gases issuing from the last vessel contain neither CO_2 nor H_2S and are allowed to escape ; but finally action commences between the CO_2 and CaH_2S_2 according to the equation :

$$CO_2 + CaH_2S_2 + H_2O = CaCO_3 + 2H_2S.$$

When H_2S is observed to issue in considerable strength from any vessel of the series, that vessel is connected directly with a gas holder and the gas collected as long as it continues of sufficient richness.

After collection, the gas may be burned directly for preparation

of sulphuric acid, or the sulphur may be itself recovered by a Claus kiln, working on the principle of incomplete combustion :

$$H_2S+O=H_2O+S.$$

The process is a continuous one, and a chief point thereof is the elimination of a considerable quantity of inert, diluent gases, mainly nitrogen, which are allowed to escape, leaving the remaining gases proportionately enriched. (*J. Soc. Chem. Ind.*, **7**, *162.*)

W. P. M.

Conversion of Lime Mud into Cement. J. S. RIGBY.

As a bye-product of the alkali manufacture, calcium carbonate (lime mud) is produced in a state of subdivision comparing favorably with the finest ground limestone. The author's method of converting this into cement, consists in first washing the mud as free from alkali as possible and mixing with a good clay, in such proportions as will give the finished amount the following composition :

Lime	62.
Alumina and iron oxide	10.
Silica	22.

The mixture is then dried and charged into kilns with alternate layers of coke.

The process is patented. (*J. Soc. Chem. Ind.*, **7**, *301.*)

W. P. M.

Effects of Food-preservatives on the Action of Diastase. HENRY LEFFMAN and WILLIAM BEAM.

One-half c. c. maltine, diluted to 5. c. c. and added to 100. c. c. starch solution was the liquid used in following table :

Antiseptic used.	Proportion.	Fehling's Solution required.
None	———	245. c. c.
Salicylic acid	1 to 500	No sugar formed.
" "	1 " 1,000	" " "
" "	1 " 20,000	245 c. c.
Boric acid	1 " 1,000	245 "
Sodium acid sulphite	1 " 1,000	245 "
Saccharin	1 " 1,000	18.5 c. c.
"	1 " 500	5.6 "
Beta-napthol	1 " 1,000	204 "
"	1 " 500	174 "
Alcohol	1 " 25	245 "

EXPERIMENTS WITH DIASTASE.

Proportion of Diastase.	Antiseptic.	Proportion of Antiseptic.	Fehling's Solution required.
1 to 500	None	———	300.5 c. c.
1 " 500	Salicylic acid	1 to 3,000	286 "
1 " 500	"	1 " 1,500	16 "
1 " 500	"	1 " 1,000	No sugar.
1 " 1,000	None	———	263 c. c.
1 " 1,000	Salicylic acid	1 to 1,000	No sugar.
1 " 2,000	None	———	238 c. c.
1 " 2,000	Salicylic acid	1 to 5,000	82 "
1 " 2,000	"	1 " 3,000	No sugar.
1 " 1,000	Boric acid	1 " 1,000	250 c. c.
1 " 1,000	Sodium acid sulphite	1 " 1,000	263 "
1 " 500	Saccharin	1 " 1,000	86.3 "
1 " 1,000	"	1 " 1,000	No sugar.
1 " 1,000	Beta-napthol	1 " 1,000	238 c. c.
1 " 1,000	Alcohol	1 " 25	250 "

The inferences are that salicylic acid is especially objectionable in a malt extract, and that saccharin is also unsuitable.

Boric acid and sodium acid sulphite seem to have but little retarding effect. (*Analyst*, **13**, *103*.) W. P. M.

A New Antiseptic Soap. John Thompson.

The soap contains 1 to 3 per cent. of biniodide of mercury, dissolved in potassic iodide. For use, the watery solution of the soap is diluted until the quantity of the salt present reaches 1 in 2,000 or 1 in 4,000.

The advantages of iodide over the chloride of mercury are, that it is not so poisonous, is a much more powerful antiseptic, and makes a good and effective combination with soap. (*J. Soc. Chem. Ind.*, **7**, *192*.) W. P. M.

Action of Petroleum on Lead. Wm. Fox.

On tanks in constant use, a deposit is formed consisting of carbonate and hydrated oxide, together with a small quantity of valerate of lead.

Experiments support the probability that the white lead, of which the powder practically consists, and a paraffin, is formed

by the action of an oxidizing agent and a small quantity of valeric acid present in the petroleum. (*Chem. News*, **58**, *39*.)

W. P. M.

Note on Rave's Process for the Utilization of the Acid Tar Residues of Petroleum Manufacturers. W. P. THOMPSON.

The acid tarry material formed by refining petroleum with sulphuric acid, has, until recently, been a waste product. The *Sociétè Oléo Graisse* are at present engaged in utilizing it by Rave's process. The acid tar is kneaded with iron cuttings or filings, the iron being in slight theoretical excess. After more or less time the acid combines as metallic sulphate.. Hot water is added. The sulphate dissolves, the excess of iron falls to the bottom, and the black mass melts and rises to the surface. After thorough washing this black mass is found to possess all the mechanical proportions of the best purified soft bitumen. The solution of sulphate is drawn off and allowed to crystallize. The "bitumen" is heated in a still until it assumes almost any required degree of hardness. According to the amount of heating there may be obtained : 1. An elastic substance, strongly resembling India rubber, or 2, a material hard and tough as ebonite, which is an extremely good non-conductor of electricity, is unacted upon by acids or alkalies, and is therefore well adapted for making galvanic batteries, coating acid tanks, and the like.

Upon pushing distillation to the extreme, a bright metallic looking carbon is left which is hard enough to scratch glass and is a remarkably good conductor of electricity. (*J. Soc. Chem. Ind.*, **7**, *303*.)

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380,927.—Production of azo colors. A. F. Poirrier and D. A. Rosenstiehl. Nitro-aromatic amines, particularly melanitraniline, the isomeric nitrotoluidines, melting at 107° and 78°, and nitroxylidine melting at 123°, are reduced in an alkaline medium. The polyazo derivatives of these reduction products are combined with the phenols, the oxyphenols, the naphthols, the oxynaphthols, the primary, secondary and tertiary amines, and also the alkyl, sulpho and carboxyl derivatives of all these bodies.

381,045.—Manufacture of purple black azo dyestuff. O. N. Witt.

381,046.—Purple azo dyestuff. O. N. Witt. W. R.

JOURNAL

OF THE

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MAY,

1888.

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ABSTRACTORS:

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CONTENTS:

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The Journal of the American Chemical Society appears monthly, except during July and August. It will contain all papers read before the Society, as well as abstracts from American and Foreign Journals, and a list of American Patents relating to Chemical Industries.

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The Committee on Papers and Publications respectfully call attention to the resolutions of the Society, requiring that papers be submitted to the Committee before being read.

Authors will be furnished, gratis, with 20 reprints of each article published in the Journal, if application for the same be made when the article is sent.

Members are requested to give notice of any change of address, or failure in the delivery of the Journal. All communications relating to the Journal should be addressed to the Editor.

A. A. BRENEMAN, 97 Water St., New York.

REGULAR MEETING, Friday, May 4th, 1888.

Vice-President Breneman in the chair.

Minutes of meeting of February 3d were read and approved.

John S. Adriance, of Huntingdon, Pa., was elected a member.

The following were proposed for membership: Dr. M. J. Leland, of Brooklyn, N. Y.; W. T. Jenkins, M.D., of New York.

The following paper was read: "The Active Principle of Rennet, the so-called Chymosin," by Dr. L. H. Friedburg.

The following resignations were accepted: C. J. Roney, E. H. Lecour, A. R. Ledoux.

The meeting was then adjourned.

T. D. O'CONNOR,

Recording Secretary.

ON THE ACTIVE PRINCIPLE OF RENNET, THE SO-CALLED CHYMOSIN.

By Dr. L. H. Friedbvrg.

(*Read before the* American Chemical Society, *May 4, 1888.*)

The study of the formation of cheese from milk by means of rennet extract has always been a very inviting one. While the cheese manufacturers endeavored to find out how to obtain a very active rennet extract, and for a number of years manufactured it themselves, they were careful at the same time to study the conditions under which such extracts acted. Scientific chemists in their researches, added, as a matter of course, the critical inquiry into the nature of the active principle, its preparation and the manner of its chemical action.

At first sight the chemist is inclined to compare. Glancing at the curdling of milk he finds that a comparatively small quantity of the curdling substance acts upon a relatively enormous quantity of liquid with a given effect. He knows of similar actions more or less unexplained in the vast territory of general chemical reactions, I mean those which in former times were called "catalytic," and which, at present, are generally known as "contact" actions. I recall the formation of ammonium nitrite from ammonia and air in the presence of a glowing platinum spiral, or of formaldehyde from methyl alcohol, under similar conditions. He understands that in these cases the contact substance in a glowing state acts as a conveyer of oxygen. In the general case of etherification the sulphuric acid is no longer considered as a "contact" substance, since we know that the part it plays in these actions is that of taking up the elements of water with which it dilutes itself, from two different chemical compounds containing them. The study of this latter case has contributed

much to the present tendency to assume that all the so called contact actions, when sufficiently studied, will prove to be simple chemical reactions under peculiar conditions.

From a chemical standpoint we are not yet clear as to the peculiar action of rennet upon milk ; more than that, we have not yet studied the chemically active principle so as to be familiar with it as we are with sulphuric acid, or even with glowing platinum.

In our case matters are, moreover, complicated by the fact that several substances have the peculiarity of curdling milk, such as certain juices extracted from plants*—that a precipitation of casein, by means of acids, different from the real curdling of milk by rennet may take place and confuse the observations; and finally, that the state in which the casein is actually contained in milk (let us call it the physical state), seems to be a very peculiar one, perhaps similar to glue, when we speak of its colloid nature to absorb water and swell with it, so that the entire fact of the curdling of milk by means of rennet cannot be expected to offer us simple conditions of observation.

Since we do not feel justified in assuming that the active principle in milk coagulation is the same in an extract of the stomach of ruminants and in the juices of certain plants, we are led to suppose that different substances react here in a similar manner upon one and the same body. By means of such conclusions we may succeed in devising correct experiments for the solution of the question before us.

Let us first see then how far we have succeeded in this up to the present time.

We find that the coagulation of milk by means of rennet depends upon the quantity of rennet added, as far as the practically important fact of rapidity of coagulation is concerned. This is not surprising if we consider that a larger quantity of active substance attacks the body upon which it is made to work, over a larger area—

* A. Mayer proved that the action of the extracts of *Cirsium Arvense Oxalis Acetosella, Rumex Patienta, etc.*, coagulated milk by force of their acidity; while *Cynara Scolymus* (artichoke) and, according to Wittmack, also *Carica papaya* and *Ficus Carica* curdled *per se*.

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particularly since my own experiments have satisfactorily proved to me that *milk* churns quicker if butter is added, a fact which I suppose is known also in dairy establishments, but for the explanation of cheese precipitation we have to look for other facts.

To my knowledge the first one who, though unsuccessfully, attempted to obtain the active principle of rennet extracts (rennet) was Deschamps. (*Dingler's Polytechnisches Journal* 1840, No. 78, P. 445). He thought that he had found the real active principle of rennet, to which he gave the name "chymosin." Deschamps' results were tested and contradicted by Dr. Husemann in Chur who found the chymosin prepared according to Deschamps' method to be nothing but a mixture, of the weakest coagulating power possible, and consisting mostly of calcium phosphate and mucous nitrogenous organic substances, so that it could not be the active principle of rennet.

Liebig, (*Chemische Briefe*, 1865, page 159); Hallier, (*Gährungserscheinungen*, 1867, page 39), and Soxhlet, (*Journal f. praktische Chemie*, vol. 6, page 29 to 38), differed in regard to the peculiarity of the action of rennet.

Liebig, in accordance with his general ideas on fermentation, thought that as soon as a decomposition of the mucous membrane of the stomach had begun, the membrane then had the faculty of transforming the sugar of milk into lactic acid, which then would neutralize the alkali which keeps the casein dissolved, thus precipitating this latter.

Hallier thought that only the organisms contained in calf's stomachs were the cause of coagulation and that microbes of *penicillium* would coagulate milk as quickly as rennet.

In Liebig and Hallier we see also on this subject quite general expressions of the two opposite ideas in regard to the cause of fermentation, characteristic of the period.

Soxhlet's conception was, that the difference between coagulation of milk by means of rennet and spontaneous coagulation was only to be found in the fact that under the influence of rennet it took place more quickly. According to him rennet would transform sugar of milk into lactic acid, by means of which the neutral alkaline phosphate contained in milk would be transformed into the

acid salt. If now, consequently *that* definite proportion between neutral and acid phosphate be arrived at, in which the albuminoid (casein) is just kept in solution at low temperatures, and if then the temperature be raised, the albuminoid would be precipitated even if the liquid showed the alkaline reaction. That the acid reaction was also present was, of course, particularly remarked by Soxhlet.

We see that Soxhlet at that time did not admit a difference between coagulated and precipitated casein. We know to-day that in the first place cheese differs mainly from casein by its insolubility in water in which casein is readily soluble, then by its contents of calcic phosphate.

It seems to me, that of the many excellent investigators of this subject "Olof Hammarsten" has pushed the knowledge of milk coagulation by means of rennet farthest, and it was he, who for the first time really prepared the "*chymosin*" or "*lab,*" as he calls it in a pure state," particularly free from its companion pepsin. Hammarsten's original report (*Upsala Läkareforenings Förhandlinger,* Vol. 8, 1872, pp. 63-86), was not attainable, but I have read an extract of it in Maly's *Jahresbericht über die Fortschritte der Thierchemie,* 2 Vol., 1872 (ed. 1874), page 118, *et seq.* Hammarsten's researches date sixteen years back. He begins by confirming Soxhlet's observation, that normal, new cow's milk reacts almost invariably amphoteric. He then points out that it is of the greatest importance for the study of the process of coagulation, to work with ferment solutions of great strength, so that the coagulation might take place within a few minutes, thus avoiding a formation of lactic acid which will set in after 1 to 2 hours, and which would lead to a complex result from which no conclusions could be drawn, as he shows further on. He prepares infusions of the mucous membrane of calf's stomach by means of $\frac{1}{10}$ to $\frac{2}{10}$ per cent. hydrochloric acid and states that by 1 c.c. of such an infusion, which may have been previously neutralized or even rendered slightly alkaline, 25 c.c. of new milk will be curdled in two minutes at 36 to 38° C. The reason for preparing a solution by means of hydrochloric acid will be given later.

He then made the following experiments. New cow's milk that had been rendered slightly alkaline by the addition of sodium hydrate was curdled within 4 to 10 minutes by means of an infusion of neutral reaction. The coagulation was complete, so that not a trace of casein could be found in the whey, when tested by means of acids.

The reaction in these experiments was tested from minute to minute, but was not found to have changed either before, during or after coagulation. It was all the time an alkaline one.

Though these experiments speak in favor of the curdling of milk independently of lactic acid formation, Hammarsten furnished the decisive proof of this in another manner. He prepared casein solutions which were entirely free from sugar of milk. This is done by precipitating from milk by means of common salt, applied in a powdered state, the fat and casein and a little albumin, leaving the sugar of milk, most of the albumin and salts in the filtrate. The coagulum is washed with a concentrated sodium chloride solution. Then the curd is taken up with water and the butter is separated for the most part by strongly shaking the mixture. A filtration through linen and a new precipitation by means of common salt follows. The precipitate is pressed thoroughly between bibulous paper so as to free it from most of the sodium chloride, then dissolved in water and filtered through linen or filter paper of rather loose texture. Thus a casein solution is obtained which contains casein and fat but no sugar of milk. This solution remains unchanged in a warm state but upon addition of some of the ferment solution it curdles exactly like ordinary milk. This experiment succeeds not only with the above described impure infusion but also if the perfectly pure ferment, the description of which will follow, is used.

The conclusion to be drawn from these experiments is, that solutions of casein free from sugar of milk coagulate quickly with rennet, exactly as milk does, even with amphoteric or weak alkaline reaction. Therefore the curdling process is a something entirely independent of the formation of lactic acid.

A further proof regarding the non-significance of sugar of milk for the curdling of milk is furnished by Hammarsten by pre-

paring a ferment from the mucous membrane of the calf's stomach which instantaneously coagulates milk or solutions of casein free from sugar of milk, while it is entirely without action upon sugar of milk alone. For this ferment, which is not identical with pepsin, Hammarsten proposes the name *lab.* It *is* evidently the real chymosin, which Deschamps supposed he had found.

The "lab" shows almost all the same reactions as the pepsin, but since it is easier to destroy lab than pepsin, it is more difficult to get pure lab solutions than pure pepsin solutions.

The method according to which Hammarsten prepared lab solutions, free from pepsin, consists in the first place in a fractional precipitation by means of magnesium carbonate or solution of lead acetate. Both ferments, pepsin as well as lab, are in this way mechanically precipitated, but for some reason it is possible, perhaps because the pepsin is more easily precipitated, to free liquids entirely from pepsin, while a goodly amount of lab remains in solution. Hammarsten thus prepared solutions, which at blood heat coagulated milk of neutral reaction within 1 to 3 minutes, while properly acidulated, they did not peptonize a little pouch of boiled fibrin.

In order to prepare the lab in a pure state, fractional precipitation by means of lead acetate was applied. The pepsin having been almost or entirely removed, lead acetate, with the addition of very little ammonium hydrate, is used for precipitation. The precipitate is decomposed by means of very dilute sulphuric acid and the acid solution, containing mere traces of albumin, is mechanically precipitated according to Brücke's method (used by B. for pepsin) with the aid of cholesterin, or by means of a watery solution of palmitin and stearin soap.

The method described yields good results only in case the original infusion was rich in lab. The liquids, diluted with ten times the amount of water, must still be so strong that 1 c. c. will coagulate 5 c. c. of milk at blood temperature in one minute.

The pure lab gives the following reactions according to Hammarsten: it does not show the xanthoprotein reaction; watery solution does *not* coagulate it on boiling, it is *not* precipitated by

alcohol, nitric acid, tannin, iodine or normal lead acetate, but is precipitated by basic lead acetate. The impure lab on the contrary *is* precipitated by the same reagents.

Alcohol destroys the lab at neutral reaction only slowly. Increase of time of reaction and augmentation of alcohol also increase the amount of lab destroyed.

Fixed caustic alkalies act strongly to decompose lab, particularly at higher temperatures.

The resistance of lab to heat differs with neutral or acid reaction. A solution rich in lab may be momentarily heated to + 70° C., without losing all its ferment, whilst the same solution, acidulated with $\frac{3}{10}$ per cent. of hydrochloric acid loses all its ferment if momentarily heated to + 63° C. or even after heating it for forty-eight hours to + 37° or 40° C. Pepsin on the contrary is not so easily destroyed in acid solutions; we have therefore a comparatively easy means of preparing pepsin solutions free from lab by heating the acidulated liquid for a certain time up to + 40° C.

The only physiological action of lab, according to Hammarsten, is that upon casein, which it coagulates at neutral, acid, or alkaline reaction. The effect appears latest in alkaline solution, and a small excess of alkali is sufficient to destroy it altogether. The best action is obtained in acid solution, and it was shown by controlling experiments that acid to that amount *alone* would not be the reason of coagulation.

The addition of certain salts (as we have seen above) retards or even stops a coagulation altogether.

Sugar of milk is not changed by lab into lactic acid, nor is albumin digested by it.

Hammarsten puts the question : in which part of the mucous membrane of the stomach is the lab generated? He finds that the pyloric part is much poorer in ferment than the fundus. The stomachs of calves and sheep always showed the presence of lab, while those of the other mammals and birds often failed to contain it. The stomachs of fish hardly ever showed it.*

* Journal of the Society of Chem. Industry, March, 1887, page 191 : F. Baden Benger states that Sir Wm. Roberts obtained it from the digestive organs of the fowl, and Baden Benger has extracted it from the stomach of the codfish.

But it was found that this variable behavior of the infusions depended upon the more or less strong spontaneous formation of acid, and a continued research taught that the mucous membrane of every animal heretofore studied in this regard, contains a water soluble substance which is not lab, but out of which lab is formed in a short time after addition of an acid. Experiments in this regard were performed with the infusion of a pike's stomach, which, by means of a titred hydrochloric acid was brought to an acidity of 0.1 per cent. After twelve to twenty-four hours the liquid was exactly neutralized, and a liquid was thus obtained which coagulated milk within a few minutes.

The fact that there exists a substance in the mucous membrane of the stomach, which, on addition of an acid yields lab, furnishes an explanation *why* acidulated water produces an infusion richer in ferment than neutral water.

Finally, the following statements are made by Hammarsten in regard to the coagulation of milk at acid reaction. An acid infusion of 0.1 per cent. hydrochorlic acid was divided in two portions. One half was heated for some time, using 70-80° C. in a closed vessel and, after cooling, five times its volume of new cow's milk was added. This mixture remained for hours liquid at the temperature of the blood, while at the same temperature the non-heated infusion, the same milk in the same proportion, coagulated instantaneously.

This shows that the ferments of the calf's stomach at acid reaction act very energetically, but the question to be answered was still this : is this action besides being due to the lab also to be attributed to the pepsin? His experiments permitted him to conclude that pepsin solutions, freed from lab in the above mentioned manner, when neutralized, showed no effect upon milk, while in acid solution there seems to be still a slight action present.

I shall have to show later on that my own experiments have forced me to draw the conclusion that pepsin free from lab, even in acid solution, does *not* coagulate milk.

Since the pure lab is without action upon sugar of milk, or albumin solutions containing sugar of milk, while the impure neutral rennet extract shows this reaction, Hammarsten is justified in

concluding that the mucous membrane of the stomach contains a third ferment, which forms lactic acid. And it is possible to prove in a different manner the presence of such a substance. Both pepsin and chymosin (lab) can be destroyed by means of sodium hydrate solution, but the remaining liquid, free from either lab or pepsin, still converts sugar of milk quite energetically into lactic acid. Therefore a third ferment, forming lactic acid *is* contained in the mucous membrane of the stomach, and the frequent references to the fact that milk at coagulation turns acid are easily reconciled with these apparently diverging remarks. Because, if we work with a liquid poor in lab, the spontaneous acidulation of the milk, the action of the ferment which forms lactic acid, comes into play, and the milk may turn sour before coagulation. But if liquids rich in lab are used, which act strongly and rapidly, so the other ferment has no time to begin its action and the milk coagulates at amphoteric or alkaline reaction.

Hammarsten's conclusions are as follows. The mucous membrane of the stomach contains, beside pepsin, two ferments, the one, lab, the other the lactic acid forming one. Of these two, only the first named one has a specific action upon casein, while the latter exclusively attacks the sugar of milk. The reaction of this latter ferment only comes into play exceptionally when cheese is formed and *if* the casein is precipitated by this secondary factor, lactic acid, this is a chemical process non-identical with the formation of cheese.

Within the stomach of the living animal the possibility of a coagulation of milk by means of acid alone, seems only to be actually existing in the newly born animal. Hammarsten found in the stomach of young dogs, one to two days old, neither pepsin nor lab, not even in cases in which the stomachs were filled with coagulated casein and contained a strongly acid liquid.

A considerable length of time after these researches of Hammarsten, a patent was granted to M. Blumenthal in 1886, for the practical and wholesale manufacture of chymosin. The patentee describes his own method of preparation (U. S. Pat. No. 344,-433 as follows):

"I have found that chymosin, the active agent in milk, may be obtained from rennet or the stomachs of ruminants, and more especially that of the calf, which contains comparatively little pepsin, the chymosin preponderating; in the stomach of the pig or sheep, on the the other hand, I have found that pepsin preponderates. Hence, if the chief product is to be chymosin, it will be found of advantage to employ the stomach or rennet of the calf as a raw material, and if pepsin is to be the chief product it will be of greater advantage to employ the stomach or rennet of the sheep or pig.

The treatment of the raw material being the same whether the stomach of the pig or that of the calf or other ruminant is employed, I will confine this description to the treatment of the stomach of the calf with a view to obtaining chymosin as a principal and pepsin as a by-product. The stomach of the calf is cut into small pieces and macerated or digested for about twenty-four hours in a solution preferably of common cooking salt, containing about 0.5 per cent. of salt, kept at a temperature of 30° C, more or less. The solution is then filtered, and a small amount of mineral acid is—such as hydrochloric, sulphuric, or phosphoric acid—mixed therewith in the proportion of about 0.1 per cent. The reaction of the acid on the saline solution gives rise to a thick precipitate of mucous matter, which contains but traces of chymosin and no pepsin, the solution during the acidulation being preferably kept at a temperature of about twenty to thirty degrees C., as at that temperature the mucous matter agglomerates more rapidly or readily and may, in this condition, be easily separated from the solution which is effected only with the greatest difficulty otherwise. The filtered solution is again acidulated to the extent of about 0.5 per cent. of acid and pulverized cooking salt is added until a precipitate of the latter is formed.

This supersaturated, acidulated salt solution is now brought to a temperature of 25 to 30° C and kept at this temperature for two or three days under constant agitation and then allowed to rest for a day or so, the temperature being increased to 30 or 35° C. A separation then takes place in the form of a white flocculent substance, which floats on or in the solution, and may be readily

collected on a filter, and then dried at a temperature of about 28° C. The substance separated from the solution is the pure zymotic product called 'chymosin.' It is an amorphous, white, gelatinous substance greatly resembling aluminium hydrate, is without taste or smell, and soluble in water, forming a limpid or clear solution. It may be kept for years without deterioration, and is not injured by temperatures reaching as high as 35° C. The remaining saline, supersaturated acid liquor or mother liquor free from chymosin does not cause milk to curdle when mixed therewith, the active agent, chymosin, which alone produces this reaction in milk, having been eliminated. The pepsin held in solution in this mother liquor may now be separated therefrom by neutralizing the solution with an alkali and agitating the same for some time, the pepsin being obtained as a gelatinous precipitate insoluble in the concentrated neutral salt solution but soluble in the acid salt solution.

Pure pepsin may also be obtained from the so-called 'impure pepsin essence,' or 'extracts of rennet of commerce,' by acidulating these extracts or the solution of the dry rennet with one of the mineral acids above referred to in the proportion of about 0.2 per cent. of the acid, whereby the impurities are precipitated. These are removed by filtration, an excess of cooking salt added, as described, to separate the chymosin which is collected, and the remaining solution is neutralized to precipitate therefrom the pepsin. In this case, also, chymosin and pepsin are separately obtained free from any albuminous mucous or other impurities."

Here then is offered an entirely new way of preparing the active principle for milk coagulation, for which the inventor very aptly uses the name chymosin.

Experiments which I performed myself at different times, working exactly according to the directions of this patent convinced me of its value. Working on a small scale and using about five calf's stomachs at a time, the preparation of chymosin was performed successfully. The only difference from the results, as stated in the patent, is a very agreeable one, *i. e.*, "that on so small a scale the chymosin is obtained immediately after supersaturation of the acid solution by common salt (Na Cl). A snow white substance

accumulates then, floating upon the liquid. It is even preferable at once to skim off this substance from the liquid and to put it on porous clay or a piece of glass, because it easily might be lost in the three to four days' consecutive standing of the liquid, either because the small amounts of chymosin obtained sinks down to the surface of the salt and is thus rendered inaccessible, or because under such conditions it might decompose." I advise the removal of the white surface at once and then letting the liquid stand to see whether the crop will be augmented after a few days, as the patent indicates.

Comparing the reactions that this substance yields with the reagents which Hammarsten used for characterizing his lab, I found each and every one reaction to be also correct for Blumenthal's chymosin, so that I am inclined to consider the two substances as identical.

Since I referred above to Hammarsten's remark, that it seemed as if pepsin still and *eo ipso* had a slight power of coagulating milk, I made the following assay. Merck's pepsin was taken and freed from chymosin according to the above mentioned patent. The resulting pepsin, which was perfectly odorless and dissolved to an almost absolutely clear liquid, digested albumen actively, while in a very slightly acid solution (of HCl) it did not curdle milk within forty-eight hours and this same milk would always curdle in the shortest time when at the end of the above mentioned period of the experiment chymosin was added.

It seems, therefore, that according to the patent, the separation of chymosin from pepsin is more thoroughly arrived at than in Hammarsten's fractional precipitation and consecutive heating of the substance to a temperature at which it is supposed that chymosin is destroyed. Besides, it would follow, that under such conditions (the pepsin of Hammarsten actually showing the power of curdling), the chymosin is not fully destroyed.

Pure pepsin, free from chymosin, does NOT *curdle milk according to my experiments.*

On the other hand, I have to confirm the statement that the time of curdling milk by chymosin is shortest in acid solution and longest if the solution is purposely made alkaline.

In regard to the systematic analysis of chymosin products as they are offered to the consumer, I intend to present later, if time permits a shortpaper. I only wish here to point out the fact that great care has to be taken in determining the nitrogen, *i. e.* the albuminoids. If the analysis be performed according to the Kjeldahl method, results are obtained which do *not* permit multiplication of the nitrogen found, by 6.25, to indicate albuminoids. It will almost invariably be found, that the quantity of albuminoids, so calculated, is greater than the total quantity of organic substance, the "loss by ignition." If, on the other hand, the soda lime determination is used, the result of multiplication by 6.25 remains within reasonable limits.

But whether the truth is revealed by the soda lime determination, or whether the chymosin is so constituted as not to permit the ordinary calculation of nitrogen found in it to albuminoids by applying the factor 6.25, remains still a mystery to me. The Kjeldahl method being approved and rendering good service in so many cases, may here be misleading, but we certainly know that the soda lime method is not an infallible one and thus we stand before the query: does the chymosin belong to the albuminoids proper?

I intend to approach this question by preparing chymosin entirely free from chloride of sodium etc., which requires time and is by no means an easy matter, and then to perform the nitrogen determination by means of cupric oxide.

COLLEGE OF THE CITY OF NEW YORK, May, 1888.

ABSTRACTS.

GENERAL AND INORGANIC CHEMISTRY.

Application of a Process of De Senarmont for the Reproduction of Celestine and Anglesite by the Wet Process. L. Bourgeois.

De Senarmont obtained cyrstallized barium sulphate by heating in a sealed tube at 250° for 60 hours, barium chloride with hydrochloric acid, obtaining barytine under the forms mpb^1; $mpb^1 a^2$; $b^1 a^2 e^1$. The author has realized the crystallization of strontium sulphate and of lead sulphate under the same conditions, and the crystals have dimensions permitting their crystallographic study. (*Bul. Soc. Chim.*, **49**, *28.*) M.L.

ABSTRACTS.

ORGANIC CHEMISTRY.

Action of Crystallizable Formic Acid on Citrenol. J. Lafont.

The author has already signalled the action of formic acid on camphene and the formation of camphene formiate.

The phenomena are different when citrene is substituted for camphene, which, although belonging to the terpilene series, has the composition $C_{20}H_{16}$.

The citrene used distilled at 175-178° and had a rotary power of $X]_d = +93°$. The author describes his experiments in detail. Unlike Camphene which combines easily with formic acid, citrene, a divalent hydrocarbon, shows no combination; the principal action is an action of polymerisation yielding a hydrocarbon $C_{40}H_{32}$ and a small proportion of a rosin-like body. The author proposes to call the new hydrocarbon *diterpilene*. (*Bul. Soc. Chim.*, **49**, *18.*) M. L.

On Methyl iodoform. PIERRE DE BOISSIEU.

The author prepares this body by the action of aluminium iodide on methyl chloroform, CH_3CCl_3. Aluminium iodide is prepared by dissolving iodine in carbon disulphide, then adding the theoretical amount of aluminium in sheet form. In the solution the methyl chloroform is added, drop by drop, in a proportion calculated upon the formula :

$$2\,(CH_3—CCl_3)+Al_2I_6=Al_2Cl_6+2\,(CH_3CI_3).$$

The crystalline mass obtained is pressed in absorbing paper and recrystallized from alcohol. It contains 93. 40 per cent. of iodine; melts at 95° and decomposes ; is very soluble in carbon disulphide, benzol or ether ; less soluble in petroleum ether ; sparingly soluble in cold alcohol ; soluble in hot alcohol. The author indicates a yield of only 25 to 30 per cent. without being able to assign the reason of such a low yield. (*Bul. Soc. Chim.*, **49**, *17*.) M. L.

Carbonate of Aniline. A. DITTE.

A current of CO_2 passed through aniline oil is not absorbed, nor do aniline salts undergo double decomposition with carbonates. The author has operated under a pressure (50 atm. at the temperature of +10° C.) and has observed the formation of crystals, believed to be formed by union of molecule to molecule of the two bodies present. These crystals dissociate when the pressure decreases. (*Moniteur des prod. Chim., p. 18.*) M. L.

ABSTRACTS.

ANALYTICAL CHEMISTRY.

Use of the Term "Normal" in Volumetric Analysis. A. H. ALLEN.

The author points out the confusion that arises in the preparation of solutions of such substances as potassium permanganate

or As_2O_3, when a "normal solution" is understood to mean a liquid containing the *molecular weight* in grams per litre. He advocates the use of the expression : "One litre shall contain the hydrogen equivalent of the active agent weighed in grams." (*Analyst*, **13**, *181.*) W. P. M.

Influence of Sulphur upon Eggertz's Carbon Color Test. T. W. HOGG.

The author finds that the sulphur does not oxidize to a sulphate as has been assumed, but remains free, suspended in the liquid, thereby communicating to it a certain turbidity or milkiness.

The character of the tint is changed greatly by this suspended sulphur. (*Chem. News*, **58**, *175.*) W. P. M.

Detection of Cotton-seed Oil in Lard.

Four full papers with discussions appear in the "Analyst" for September, 1888. W. P. M.

The Tintometer. J. W. LOVIBOND.

The instrument devised by the author consists of a tube divided by a central taper partition terminating in a knife edge at the eye-piece. At the other end of the instrument are two apertures of equal value, alterable by means of diaphragms. Slips of colored glass, of standard tint, are inserted through a series of transverse slots in the top, and the whole is arranged so that equal quantities of light pass on either side of the partition, illuminating the object under examination on the one hand and the glasses on the other.

Especially good results are claimed for the instrument in the examination of potable waters. (*J. Soc. Chem. Ind.*, **7**, *424.*)
W. P. M.

Analysis of Grease. L. ARCHBUTT.

The method consists in dissolving the mixture of fat acid and neutral fat in ether and shaking with a weak alcoholic solution of caustic soda, which extracts all bodies of acid character, and leaves the mineral or other neutral oil dissolved in the ether. (*J. Soc. Chem. Ind.*, **17**, *494.*) W. P. M.

ABSTRACTS.

INDUSTRIAL CHEMISTRY.

Manufacture of Explosives as Carried on by Noble's Explosives Company.

This interesting paper is the outcome of the visit of the Society of Chemical Industry to the works of the above-mentioned company. Valuable information is given concerning the manufacture and handling of nitro-glycerine, dynamite, blasting-gelatin, gelatin-dynamite and fulminate of mercury. Experiments, made for the society, are described, showing the safety, power and special uses of the several explosives.

"Kieselguhr," the silicious remains of a variety of moss, is the inert base used in the preparation of dynamite at these works, the finished product being :

Nitroglycerine	75 parts by weight.
Kieselguhr	25 " " "

Blasting-gelatin is composed of 7 per cent. of nitro-cotton, mixed with (rather practically dissolved by) 93 per cent. of nitro-glycerine. It is considered the most powerful of all explosives capable of practical use.

Gelatin-dynamite consists of 80 per cent. thinly gelatinized nitro-glycerine, with nitrate of potash and wood cellulose added in certain proportions. It is from 30 to 40 per cent. more powerful than No. 1 dynamite. (*J. Soc. Chim., Ind.*, *7*, *488*.)

W. P. M.

Action of Sulphur Chloride on Oils. C. A. Fawsitt.

The heat reaction between the chloride and certain oils is more marked than when using sulphuric acid (Maumene's test). The author gives full tabulation of his results and introduces the item of rate of rise in temperature per minute, as well as total rise. With the use of 2 c.c. of the chloride the rise in temperaure varied

from .05° C per minute for palm nut oil, to 27.7° C for castor oil. For total rise, the variations were from 9° C for palm nut, to 112° for seal oil. (*J. Soc. Chim., Ind.*, 7, *552.*) W. P. M.

Treatment and Distillation of Peppermint Plants. A. M. Todd.

The question is considered as to whether the 20,000 tons of peppermint plants, annually raised in the States of Michigan and New York (averaging a yield of one pound of essential oil per 350 pounds of plants), should be distilled in the green state or after thorough drying. Careful experiments show that there is no perceptible loss of the essential oil by the most thorough drying prior to distillation, and that the increased expense of distilling and shipping green plants is consequently not warranted. (*J. Soc. Chim., Ind.*, 7, *550.*) W. P. M.

Abstracts of American Patents Relating to Chemistry.

(*From the Official Bulletin of the U. S. Patent Office.*)

April 17th, 1888.

381,182.—Production of blue-red azo dye stuff by the action of tetrazoditolyl salts on betanaphtylamine monosulpho acid. E. Hassenkamp.

381,354.—Pyroxyline varnish. W. D. Field.

Pyroxyline is dissolved in the acetic acid derivatives of the lighter alcohols of fusel oil.

381,369.—Filter press. A. Heberer.

381,471.—Process of producing blue-red coloring matter. E. Hassenkamp.

Salts of the tetrazo compounds of paradiamines, or their sulpho and carboxylic acid are combined with the new alkylnaphthylamine sulpho acids.

381,508.—Process of making soap. R. A. McCullough.

381,507.—Gunpowder. C. J. Olds.

Consists of carbonized peas combined with saltpeter, sulphur, and charcoal made from willow or other trees.

April 24th, 1888.

381,542.—Solution for voltaic batteries. C. E. Egan.

Contains ferric sulphate and a chromic compound or chromic acid.

381,685.—Apparatus for obtaining phosphorus trichloride. C. Fahlberg.

381,718.—Metallic alloy. H. Ostermann and A. Priss.

Consists of platinum 40–50 parts, copper 15–20 parts, nickel 25–35 parts, tungsten 1–2 parts, cobalt 1–2 parts and cadmium 1–2.5 parts.

381,719.—Metallic alloy. H. Ostermann and A. Priss.

Consists of gold, palladium, copper, silver, tungsten and cobalt.

381,784.—Alum tanned skin. A. Waster and H. C. Koegel.

Alum tanned skin is subsequently impregnated with chromium sesquioxide.

381,882.—Process of obtaining ammonia and bone black. F. Egner.

The gaseous products from the carbonization of the bone black are mixed with combustible gas from a gas producer.

May 1st, 1888.

381,996.—Apparatus for causticizing soda, etc. G. W. Hammond.

382,070.—Process of manufacturing orange mineral and red lead. A C. Bradley.

Finely comminuted metallic lead is dropped through a current of sufficiently heated air to oxidize it, and the resulting litharge is roasted.

382,105.—Method of coloring glassware. H. E. Mueller.

The process consists in painting glassware with a pigment, burning the pigment, and subjecting the glassware to the action of coal gas in a closed muffle.

382,133.—Process of manufacturing the oxides of the readily oxidizable metals for paints, etc. A. C. Bradley.

Vide 382,070.

382,159.—Process of bleaching. E. Hermite.

The material to be bleached is subjected to the action of an electrolized solution of magnesium chloride.

382,183.—Apparatus for producing metals by means of electrolysis. J. Omholt.

382,196.—Furnace for reducing aluminum. F. J. Seymour.

382,197.—Method of obtaining alumina from clay. F. J. Seymour.

The process consists in mixing the clay with a reducing agent and a flux, and with copper or other metal of greater specific and atomic weight than aluminium, and heating the mixture.

382,198.—Purification and alloying of copper. F. J. Seymour.

Copper is fused with a flux composed of phosphorus and fluorspar, and with the oxides of aluminium and zinc in presence of a reducing agent.

382,273.—Method of obtaining alumina from clay. F. J. Seymour.

May 8th, 1888.

382,368.—Process of refining dextrine. C. H. Matthiessen and J. Krieger.

An aqueous solution of commercial dextrine is allowed to ferment until the sugar originally present has been destroyed, after which it is neutralized, filtered and concentrated.

382,371.—Apparatus for the manufacture of gas. A. G. Meeze.

382,372.—Process of manufacturing gas from oil and steam. A. G. Meeze.

382,373.—Process of making coal gas. A. G. Meeze.

382,374.—Process of manufacturing gas. A. G. Meeze.

382,375.—Apparatus for the manufacture of gas. A. G. Meeze.

382,376.—Hydraulic cement. J. Murphy.

Improvement on patent 347,367.

Consists of limestone, furnace slag and clay.

382,447.—Process of coating iron and steel with rustless oxide. W. T. Wells.

The articles are subjected at a high temperature to the action of steam and carbon monoxide.

382,551.—Making sodium carbonates by sulphide of the alkaline earths. E. W. Parnell and J. Simpson.

The process consists in grinding calcium or barium sulphate, subjecting it to the action of carbonaceous matter, roasting the mixture in a non-oxidizing atmosphere, mixing the sulphide produced with ammonium chloride, and heating this mixture and conducting the ammonium sulphide evolved, together with carbon dioxide into a solution of sodium chloride.

W. R.

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Authors will be furnished, gratis, with 20 reprints of each article published in the Journal, if application for the same be made when the article is sent.

Members are requested to give notice of any change of address, or failure in the delivery of the Journal. All communications relating to the Journal should be addressed to the Editor.

A. A. BRENEMAN, 97 Water St., New York.

REGULAR MEETING, June 1, 1888.

Vice-President Breneman in the chair.

The minutes of the last meeting were read and approved.

Dr. W. J. Leland and W. T. Jenkins, M.D., were unanimously elected members.

A paper was read by Dr. C. E. Munsell, "On the Lactometer: Its Utility and Reliability."

The meeting was then adjourned.

THE LACTOMETER—ITS UTILITY AND RELIABILITY.

By CHARLES E. MUNSELL, Ph. D.*

After using the lactometer constantly for six years (1880 to 1885), an ex-milk inspector wishes to demonstrate its value, utility and reliability as a detector of adulteration, as well as to refute its alleged errors.

To obtain scientific accuracy with the lactometer, it is necessary to have an instrument which is absolutely correct, that is, exact from 90 to 110 degrees, and not over one degree in error at other points; and the examiner must be an expert, who uses all the precautions that would be needed in employing other sensitive instruments, for the lactometer is the most delicate hydrometer in ordinary use, each degree being less than one-twentieth of a degree Baumé, its modulus being the highest, $3548\frac{8}{29}$, while that of the Baumé scale is 149.

The compiler was extremely prejudiced against the lactometer when he commenced his inspections, for if analysis were useless, it would be unnecessary to employ a chemist as an inspector; therefore, for two years, no complaint was made by him unless the sample had been previously analyzed; afterwards the analysis was dispensed with unless the lactometer stood above 95 degrees, as in every case the analysis showed from three to ten per cent. more added water than the lactometric indication.

Whenever milk was found between 95 and 102 degrees, an attempt was made to discover its source, but in no instance was a cow found giving milk below 101 degrees; of course, in this search *strippers* (cows nearly dry) were avoided, as the small quantities of milk given by them would have but little influence

* Read before the American Chemical Society, June, 1888.

on the specific gravity, when mixed with that of regular milkers in a forty quart can; the sale of the milk from a cow that is nearly dry should be prohibited, the same as that of a cow shortly after calving, on account of its liability to contain pus and to be otherwise contaminated.

The milk should be taken at the regular milking time, as it is very easy to obtain samples at irregular times which will have specific gravities as low as 1.0226 (78°); and the specific gravity immediately after milking and cooling is lessened by absorption of air.

If the cream has risen it is difficult to mix the sample again; and a sample taken from the top of a bottle or can is liable to contain an undue amount of fat.

Therefore, if the specific gravity of a cow's milk is below 1.029; either the milk is abnormal, that is, from a diseased cow, or from one which is nearly dry or has lately calved; or the sample tested is not a fair average of all the milk that could be obtained from the cow at her regular time of milking; or the sample has been tampered with; or is full of air; or the lactometer used is incorrect; or the temperature is above 60° Fahr.

When the New York City Board of Health commenced its crusade against the sale of adulterated milk in 1875, the citizens were paying over $10,000 daily for water sold as milk.

During 1875, $2,300; 1876, $2,900; 1877, $5,100; 1878, $1,736; and 1879, $527 were paid into the City Treasury as fines by milk dealers.

In 1880, a systematic store inspection was made throughout the city, which resulted in a reduction of the instances where the lactometric readings were below 100 degrees from one in three to less than one in twenty, the average for the year being eleven per cent., the average specific gravity in about one-fourth of the stores in the city being 1.0308 or 106 degrees; the fines for 1880 were $4,518.

In 1881, the store inspections were continued with weekly early morning inspections to examine the milk retailed from the wagons, and night inspections to test that brought to the city by the railroads and across the ferries; these night inspections showed

that dealers had ceased to deliver watered milk to the stores or consumers, or to receive it from the farmers, as the dealer was constantly watching the milk sent by the farmer in order to refuse payment for it if watered.

As the lactometer caused the detection of watered milk, the dealers formed a combination with the creameries for the sale of skimmed milk; during the Summer of 1881, these creameries were visited under the direction of the New York State Board of Health, and although no complaints were made against them directly, the dealers, whom they supplied, were watched and the milk was inspected at the ferries; from five to ten thousand quarts of skimmed milk were destroyed at each night inspection until the traffic was stopped and the dealers fined; these fines amounted to $11,657 in 1881; $9,058 in 1882; $2,265 in 1883; $3,101 in 1884; and $2,040 in 1885.

The total fines collected from dealers for the sale of adulterated milk from 1875 to 1885 amounted to $45,202; besides nearly fifty imprisonments for terms of from ten days to three months.

The combination of dealers and creamerymen resulted in a Milk Trust, known as the New York Milk Exchange, limited; nine of the thirteen original directors of this exchange have been arrested for selling adulterated milk, and aided by the best lawyers and most depraved chemists they hired a man to act as the defendant in a test case with regard to the lawfulness of the sale of skimmed milk; the trial resulted in his conviction at General Sessions and his payment of a fine of $150. This exchange has since succeeded in having the aforesaid defendant appointed as an expert on the New York State Dairy Commission, and the consequence is that the farmers can obtain no better price for milk containing over 3 per cent. of fat than these creameries do for partially skimmed milk.

The lactometer, or centesimal galactometer, was invented by Dinocourt; for descriptions of this and other lactometers, galactometers, lactodensimeters, milk testers, and milk weighers, see Dr. H. A. Mott's article in the *American Chemist*, April, 1877, Vol. VII., p. 369.

The compiler was only employed as an inspector, and as such was kept busy examining the milk sold by his proportion of the

2,000 milk dealers and 6,000 stores in New York City, and did not investigate methods of analyzing milk, but used the method of Wanklyn, as improved by Dr. Waller, and published in Cairn's Quantitative Analysis; what suggestions he would have made with regard to the analysis have been anticipated by Dr. W. H. Kent, and published in this journal (Vol. IX, p. 182, and Vol. X, p. 32.)

Lactometers as obtained from the maker should be tested at 60° Fahr.; this is done either by comparing with a standard lactometer which is known to be absolutely correct (this is the best method when only one instrument is to be examined), or by means of standard solutions; these solutions are made of salt or dilute sulphuric acid. A 3 per cent. solution of sodium chloride has a specific gravity of 1.0217 (75°); a 4 per cent. 1.029 (100°); and a 5 per cent. 1.036 (122°); these solutions, and others at 90° and 110°, should be tested with a specific gravity bottle at 60° Fahr.

With sulphuric acid a three per cent. solution has a specific gravity of 1.019 (66°); a four per cent, 1.0256 (88°); a five per-cent, 1.032 (111°).

The fault with the salt solutions is that they vary from evaporation; the dilute sulphuric acid solutions are more constant, still they should be tested occasionally.

It is necessary to allow the lactometer to descend into the milk slowly, as the milk which remains on the portion of the stem above the surface of the sample being tested, when the entire stem is dipped, would lower the reading about two degrees; the sample should not be shaken any more than is necessary to mix any cream which may have risen, as it will absorb air; and the foam on the surface should be removed, as it makes it difficult to read the scale.

When a cow is milked, it is necessary to take the entire quantity given at the regular time of milking, as the first portions of the milk contain the most casein and sugar, and the last the most cream; milk taken from a cow whose regular yield stands at over 105° will give milk standing below 80° if the cow is remilked shortly after her regular time; the milk should be allowed to

stand for some time after it is drawn from the cow, and cooled before testing, so that the air absorbed during milking will be allowed to escape.

For accurate tests the sample should be cooled (if above 60° Fahr.) by placing the bottle or cylinder in cold water or packing with ice; or if below 60° Fahr. by setting in warm water, rubbing the cylinder with the hand, or placing in a warm room. A difference in temperature of from 2½ to 3½ degrees Fahrenheit will cause a variation of one lactometric degree, different samples of milk having different coëfficients of expansion; 3 degrees is the usual average, and is approximately correct from 40° to 70° Fahr.

Beyond these temperatures its calculation is uncertain, particularly if the temperature is near freezing or so high that the milk is liable to sour; when once frozen, the constituents of the milk appear to separate, and after thawing the specific gravity is different.

When the contents of a can of milk are frozen, the water freezes first, pushing the cream and casein towards the center, in very cold weather forming an inner core of cream; while, after melting, the ice around the exterior has a specific gravity sometimes as low as 1.008; a common trick of milk dealers being to pour out the core, and then scrape out the ice, sometimes mixing it with snow or ice.

The consistence or thickness of milk can be easily determined by allowing it to run off of the lactometer and noting its appearance over the black background of the shot in the lower bulb; this consistence is an important test, as with the opacity due to the cream, the color and taste, the examiner, with some practice, will be able to determine within one-half of one per cent. how much fat the sample contains when below three per cent., and approximately above that amount; if the milk contains less than one-half of one per cent. of fat it has a mother of pearl opalescence, which can easily be seen even by lamplight, it also looks blue and tastes very sweet; if less than one per cent., the opal lustre is still apparent, the color blueish, and tastes sweetish; if under one and one-half per cent., the milk appears like glue, color neither blueish nor yellow, and tastes

flat; if below two per cent., it becomes more opaque, slightly yellow, and tastes more milky and not so sweet; above two and one-half per cent., it is opaque, yellow, and the cream can be tasted in proportion to the amount contained.

When the cows are kept confined in stables and fed on distillery swill, or are in an unhealthy condition and fed exclusively on decayed brewers' grains, the odor of the milk will betray the fact; but the odor of milk from cows fed on brewers' grains mixed with other feed is not characteristic, if the milk is thoroughly cooled immediately after milking, so as to remove the animal heat.

The principal complaint against the lactometer is that a person who never saw a sample of milk might be deceived by testing a liquid that had about the same specific gravity—a salted solution of white glue, for instance—if he made the test, as he might of an unknown substance, from a book description.

As it is necessary to add a solution of at least four per cent. of salt to milk in order not to reduce its specific gravity, it can always be detected by its brackish taste; and the addition of burnt sugar or annatto will not conceal the opalescence of skimmed milk or the thinness of watered milk.

The following formula for a compound for circumventing the lactometer was devised by the chemist, who was employed by the Hester street coalition of dishonest dealers:

(1) One gallon of water,

(3) Three ounces of sugar,

($1\frac{1}{2}$) One and a half ounces of salt, and a little caramel;

This to be added to

(4) Four gallons of milk.

This gives a fluid which stands at 99 degrees on the lactometer at 60° Fahr., and shows on analysis:

Water, 89.06%; fat, 2.95%; casein and sugar, 6.80%; and salts, 1.19%; sodium chloride, 0.42%.

The salt can be easily detected by its brackish taste, and the dealer who offered it for sale did the State one month's service besides paying a fine.

Usually the addition of water alone was sufficient for milk adulterators of the olden time, as the easiest and most convenient;

they then ran the risk of detection, considering that the fine—if they were caught—had been paid many times by the consumer; now, the adulteration is mostly performed at creameries, where *crude* milk from the farmers is changed into *pure* milk for the city, by the addition of from twenty to fifty per cent. of skimmed milk.

Objection has been made to the use of the lactometer that it is unreliable, because, being an even scale hydrometer, the degrees are not accurately graduated ; this error of construction is very small on account of the slight range of specific gravity which it records, the greatest error being at the 50 degree mark, where the error is .714 of one degree, or .026 of an inch on the regular size of lactometer, whose scale from 0° to 100° is $3\frac{5}{8}$ inches.

See Drs. Waller and Hathaway's paper on the Modulus of Hydrometers in the School of Mines Quarterly, Vol. VI., p. 153 (January, 1885).

To find the error of a lactometric degree from the true position of the same, according to the laws of graduation of hydrometers by the specific gravity.

V. = Volume of lactometer immersed when floating in water, that is, volume of water of the same weight as lactometer.

V_1, V_2, V_3, V_4, V_5, etc., V_{10} = Volumes of lactometer immersed when floating in solutions of gravities corresponding to 10°, 20°, 30°, 40°, 50°, etc., 100° respectively, assuming that $10° = 1. + 10 \times 0.00029$; $20° = 1. + 20 \times 0.00029$, etc.

l.=Length of stem from 0° to 100°.

r.=Area of cross section, assumed to be uniform throughout.

L.=Length of lactometer assuming it to be all stem ; then

$$V = Lr. \tag{1}$$

Now for a solution of gravity equal to 1.029 ; we have the volume of liquids of same weight as the lactometer V and V_{10}. These are to each other inversely as the specific gravities of the solutions, or

$$V : V_{10} = 1.029 : 1$$

$$V_{10} = \frac{1}{1.029} = V. \times 0.971817. \tag{2}$$

Subtracting each member from V ; $V - V_{10} = 0.028183\ V$ (3)

Or the stem of the lactometer between 0° and 100° is 0.028183 of the volume of the whole lactometer.

Then lr=volume of the stem between 0° and 100°, and lr= 0.028183 Lr from (1), or dividing by r,

$l= 0.028183\ L$, or $L=\frac{1}{0.028183}l$. (4)

If the value of l is $3\frac{5}{8}$ (=3.625) inches,

L=128.623638 inches (or 10 feet $8\frac{5}{8}$ inches nearly).

If l is 20 centimeters, L=709.647659 centimeters.

If l is one meter, L=35.482383 meters.

For. solution of gravity of 50°, specific gravity 1.0145. By the same reasoning which gives us equation (2), we obtain

$V : V_5=1.0145 : 1$;

$V_5=V\frac{1}{1.0145}=V\times 0.985707.$ (5), and

$V-V_5=0.014293V=0.014293Lr.$ (6)

Volume of stem from 0° to 50°=$l_5 r$=0.014293Lr, or dividing through by r

$l_5=0.014293L$ (7)

If the 50° mark is placed just half way between 0° and 100°; it is placed at $\frac{1}{2}$ l below the 0° mark or from equation (4) at $\frac{1}{2}$ l=0.014092L, then

$l_5-\frac{1}{2}\ l=(0.014293-0.014092)L=0.000201L$ (8)

or when placed half way between 0° and 100°, it is by that amount above its true position, the measurement being made from the 0° mark, and $l_5 > \frac{1}{2}\ l$.

Assuming the value for L obtained from (4), (8) gives;

$l_5-\frac{1}{2}\ l=0.259177$ inches (9)

$1°=\frac{1}{100}$ of 3.625 = 0.03625 inch, and the 50° mark is out of place by $\frac{0.0259}{0.0362}°=\frac{3}{4}°$ nearly.

If L=709.647659 centimeters, $l_5-\frac{1}{2}\ l=0.142852$ centimeters

If L=35.482383 meters, $l_5-\frac{1}{2}\ l=0.714260$ centimeters.

For solutions of other gravities, corresponding to 10°, 20°, 30°, 40°, etc.=1.0029, 1.0058, 1.0087, 1.0116, etc.

$V : V_1=1.0029 : 1$; $V\frac{1}{1.0029}=0.997108V$

$V-V_1=0.002892V=0.002892Lr=l_1 r$

dividing by r and substituting value of L

L=128.623638 inches; l_1=0.371981 inch, $\frac{1}{10}$ l=0.3625 inch; difference=0.009481 inch too high ($l_1 > \frac{1}{10}\ l$)

L=709.647659 centimeters; difference=0.052017 centimeters

L=35.482383 meters; difference=0.260086 centimeters

For 90°=specific gravity of 1.0261;

$V : V_9 = 1.0261 : 1$; $V - V_9 = 0.25436V$,

$l_9 = 3.271680$ inches; $\frac{9}{10}\, l = 3.2625$ inches,

difference=0.009180 inch too high ($l_9 > \frac{9}{10}\, l$)

For 1°=specific gravity of 1.00029;

$V - V_1 = 0.0000728V$; difference=0.0000103 inches too high.

For 99°=specific gravity of 1.02871;

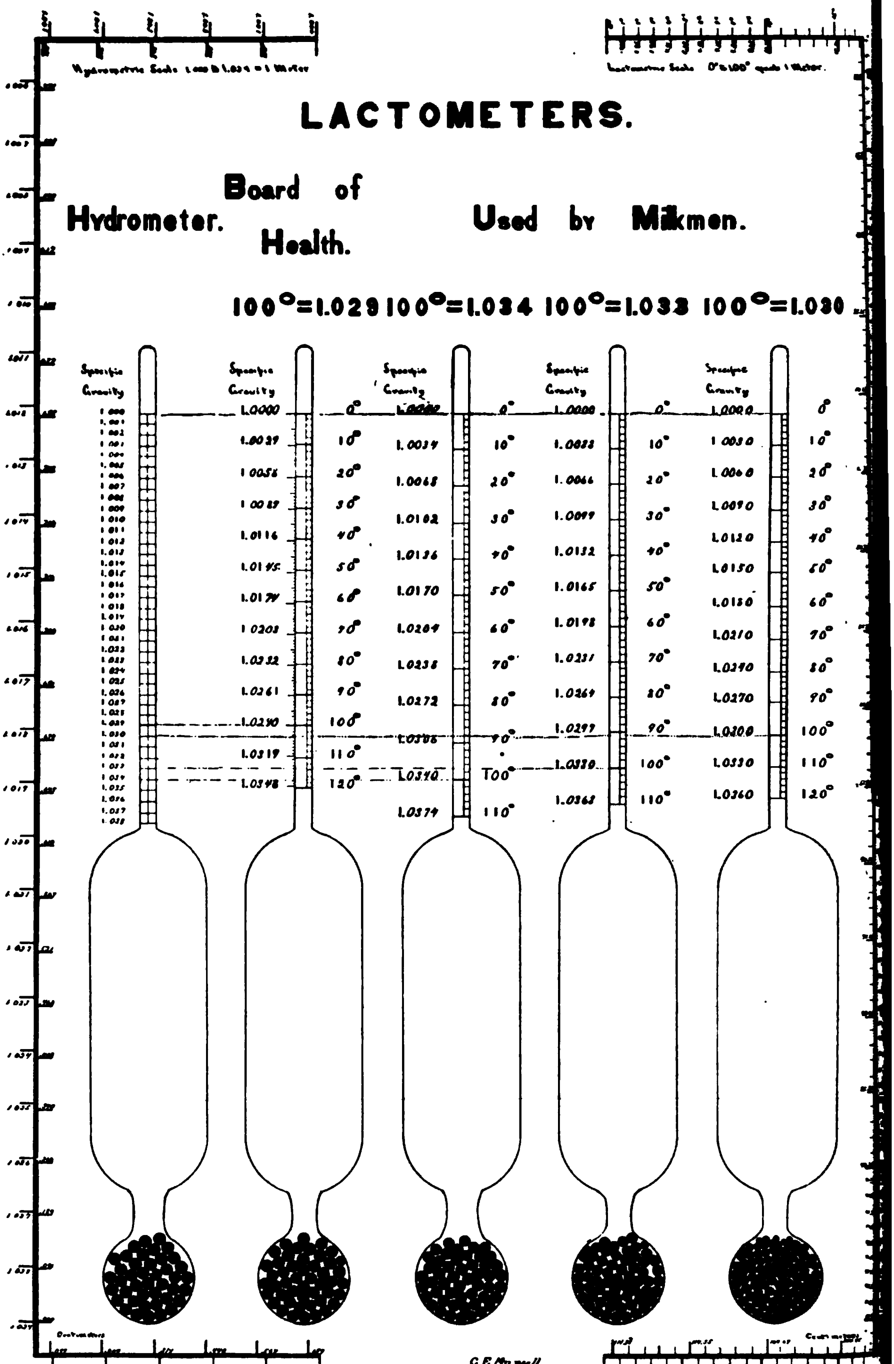
$l_{99} = 3.58974$ inches; difference=0.00099 inches too high.

Table showing difference between actual positions and proper positions for marks indicating 10°, 20°, etc., respectively, measured from 0 mark.

Lacto-metric Degree.	Specific Gravity corresponding to degrees on the Lactometer.	Reciprocals of Specific Gravities.	Difference of Reciprocals and 1.000000.	Even Scale Reciprocal of 1.029 divided by 100, and multiplied by 10, 20, etc.	Error of Even Scale in decimals of the entire length of Lactometer.	Error reduced to centimeters on a meter L = 35.482383 meters.
10°	1.0029	.997108	.002892	.002818	.000073	.260086
20°	1.0058	.994233	.005767	.005637	.000130	.461271
30°	1.0087	.991375	.008625	.008455	.000170	.603555
40°	1.0116	.988533	.011467	.011273	.000194	.687649
50°	1.0145	.985707	.014293	.014092	.000201	.714260
60°	1.0174	.982898	.017102	.016910	.000193	.683391
70°	1.0203	.980104	.019896	.019728	.000168	.596104
80°	1.0232	.977326	.022674	.022546	.000128	.452755
90°	1.0261	.974564	.025436	.025365	.000071	.253344
100°	1.0290	.971817	.028183	.028183	.000000	.000000
110°	1.0319	.969086	.030914	.031001	.000087	.309406
120°	1.0348	.966370	.033630	.033819	.000189	.672391

ERROR OF THE LACTOMETER FOR EACH DEGREE IN CENTIMETERS; DISTANCE FROM 0° TO 100° BEING ONE METER. LENGTH OF DEGREE AT 0° IS 1.028 CENTIMETERS, AT 100° .98 CENTIMETERS.

Degree.	Centimeters.	Degree.	Centimeters.	Degree.	Centimeters.	Degree.	Centimeters.
1	1.028	31	31.61	61	61.68	91	91.23
2	2.056	32	32.62	62	62.67	92	92.20
3	3.084	33	33.63	63	63.66	93	93.18
4	4.11	34	34.64	64	64.65	94	94.16
5	5.13	35	35.65	65	65.64	95	95.135
6	6.16	36	36.66	66	66.63	96	96.108
7	7.18	37	37.66	67	67.62	67	97.083
8	8.20	38	38.67	68	68.61	98	98.05
9	9.23	39	39.68	69	69.60	99	99.02
10	10.250	40	40.687	70	70.596	100	100.00
11	11.28	41	41.69	71	71.59	101	100.97
12	12.30	42	42.69	72	72.58	102	101.94
13	13.32	43	43.69	73	73.57	103	102.91
14	14.34	44	44.70	74	74.56	104	103.88
15	15.36	45	45.70	75	75.55	105	104.85
16	16.38	46	46.70	76	76.53	106	105.82
17	17.40	47	47.70	77	77.51	107	106.79
18	18.42	48	48.71	78	78.49	108	107.76
19	19.44	49	49.71	79	79.47	109	108.73
20	20.461	50	50.714	80	80.452	110	109.691
21	21.48	51	51.714	81	81.43	111	110.68
22	22.50	52	52.713	82	82.41	112	111.65
23	23.52	53	53.711	83	83.39	113	112.62
24	24.54	54	54.708	84	84.37	114	113.59
25	25.55	55	55.705	85	85.35	115	114.55
26	26.56	56	56.702	86	86.33	116	115.51
27	27.57	57	57.698	87	87.31	117	116.46
28	28.58	58	58.694	88	88.29	118	117.41
29	29.59	59	59.689	89	89.27	119	118.37
30	30.603	60	60.683	90	90.253	120	119.33


LACTOMETERS.
Hydrometer.
Board of Health.
Used by Milkmen.
100°=1.029
100°=1.034
100°=1.033
100°=1.030
Specific Gravity
1.0000 0°
1.0029 10°
1.0058 20°
1.0087 30°
1.0116 40°
1.0145 50°
1.0174 60°
1.0203 70°
1.0232 80°
1.0261 90°
1.0290 100°
1.0319 110°
1.0348 120°
1.0034 10°
1.0068 20°
1.0102 30°
1.0136 40°
1.0170 50°
1.0204 60°
1.0238 70°
1.0272 80°
1.0306 90°
1.0340 100°
1.0374 110°
1.0033 10°
1.0066 20°
1.0099 30°
1.0132 40°
1.0165 50°
1.0198 60°
1.0231 70°
1.0264 80°
1.0297 90°
1.0330 100°
1.0363 110°
1.0030 10°
1.0060 20°
1.0090 30°
1.0120 40°
1.0150 50°
1.0180 60°
1.0210 70°
1.0240 80°
1.0270 90°
1.0300 100°
1.0330 110°
1.0360 120°
C. E. Munsell, Dec. 1880.

LACTOMETRIC STANDINGS AT 60° FAHR.—OMITTING SAMPLES OF SKIMMED MILK.

Lactometer.	1880.	1881.	1882.	1883.	1884.	1885.	Total.
47	---	---	---	1	1	---	2
62	---	1	---	---	---	---	1
65	---	---	---	---	1	---	1
66	---	1	---	---	---	---	1
71	---	1	---	---	---	---	1
72	1	---	---	---	---	---	1
74	---	---	1	---	---	---	1
75	---	---	---	---	1	---	1
76	1	---	---	---	---	1	2
78	---	---	---	---	1	---	1
79	1	---	---	---	---	---	1
80	1	1	---	1	---	---	3
81	1	1	---	---	---	1	3
82	---	2	1	---	---	1	4
83	1	---	2	---	---	1	4
84	2	---	---	---	2	---	4
85	4	1	---	1	2	---	8
86	2	---	---	2	1	---	5
87	2	---	2	1	---	---	5
88	9	1	1	---	---	1	12
89	2	1	2	4	3	---	12
90	9	1	3	---	2	---	15
91	6	---	2	3	1	---	12
92	10	4	4	---	1	---	19
93	2	3	5	2	3	1	16
94	15	6	3	4	6	3	37
95	10	5	14	9	6	3	47
96	22	3	13	14	15	10	77
97	20	6	18	13	25	24	106
98	25	13	18	17	24	21	118
99	21	6	32	14	30	34	137
100	64	43	37	19	34	22	219
101	66	20	47	36	35	35	239
102	67	37	90	51	59	50	354
103	61	56	97	76	68	48	406
104	80	61	125	51	94	85	496
105	87	75	143	92	117	118	632
106	102	108	141	130	201	160	842
107	116	91	177	159	169	214	926
108	122	114	161	145	237	210	989
109	126	111	158	149	208	255	1007
110	119	89	121	128	173	134	764
111	94	101	114	135	218	227	889
112	84	77	98	116	192	178	745
113	56	32	67	53	133	129	470
114	45	25	49	31	110	99	359
115	30	8	19	9	16	13	95
116	18	3	7	3	6	---	37
117	5	4	4	1	---	---	14
118	1	3	---	---	---	---	4
119	2	---	---	---	---	---	2
120	2	1	---	---	---	---	3
Total	1514	1116	1776	1470	2195	2078	10149
Average	106.12	107.06	106.26	107.12	107.71	107.97	107.12
No. below 100°	167	57	121	86	125	101	657
Percentage	11.0	5.1	6.7	5.8	5.7	4.8	6.4

Number Analysis.	Lactometer At 60° Fahr.	Specific Gravity At 60° Fahr.	Analysis. Water.	Fat.	Casein and Sugar.	Salts.	Added Water.	Cream Removed.
189	62	1.0180	92.10	2.55	5.03	.32	40.7	15
188	66	1.0191	92.97	1.61	5.10	.32	39.8	46
171	71	1.0206	91.74	2.29	5.54	.43	33.7	24
13	72	1.0209	92.78	1.16	6.06	*	32.6	61
248	74	1.0215	91.42	1.70	6.47	.41	23.8	43
35	80	1.0232	91.31	1.31	6.76	*	24.8	56
88	80	1.0232	90.92	2.28	6.28	.52	24.4	24
173	81	1.0235	90.99	2.24	6.23	.54	25.0	25
349	81	1.0235	88.94	3.76	6.76	.54	19.0	--
192	82	1.0238	90.61	2.61	6.35	.43	25.0	13
193	82	1.0238	90.25	2.80	6.53	.42	23.0	7
8	84	1.0244	91.18	1.83	6.99	*	28.3	39
300	85	1.0247	90.07	2.71	7.22	*	19.8	10
330	85	1.0247	89.88	2.94	6.65	.53	21.0	2
9	86	1.0249	89.48	3.32	7.20	*	20.0	--
57	88	1.0255	90.94	1.84	7.22	*	19.8	38
20	88	1.0255	90.56	2.15	7.29	*	19.0	28
17	89	1.0258	88.79	3.75	7.45	*	17.2	--
327	90	1.0261	90.66	1.27	7.54	.53	10.5	57
27	--	-----	90.38	2.22	7.40	*	17.7	29
29	--	-----	89.74	2.73	7.53	*	16.3	9
16	--	-----	89.52	3.00	7.48	*	17.2	--
178	--	-----	89.37	2.74	7.29	.60	12.0	8
86	91	1.0264	90.08	2.39	6.95	.58	16.4	20
33	--	-----	89.96	2.57	7.47	*	17.0	14
14	--	-----	89.87	2.66	7.47	*	17.0	10
37	--	-----	89.78	2.78	7.44	*	16.3	7
12	92	1.0267	89.64	3.02	7.34	*	18.4	--
56	--	-----	89.20	2.98	7.82	*	13.1	--
31	93	1.0270	90.16	2.37	7.47	*	17.0	21
342	--	-----	89.77	2.57	7.07	.59	14.0	14
322	--	-----	89.60	2.62	7.22	.56	13.6	13

Other signs used in this table are as follows:

*** Salts included with Casein and Sugar.**
† Cow seen milked.
‡ Creamery milk.
§ Cows kept in Stables, and fed on Brewers' Grains.

Number Analysis.	Lactometer At 60° Fahr.	Specific Gravity At 60° Fahr.	Analysis.				Added Water.	Cream Removed.
			Water.	Fat.	Casein and Sugar.	Salts.		
308	94	1.0273	89.72	2.59	7.10	.59	14.6	14
343	--	-----	89.54	2.38	7.47	.61	10.2	20
64	--	-----	89.22	3.20	7.04	.54	15.8	--
23	--	-----	89.18	3.00	7.82	*	13.1	--
19	--	-----	89.15	3.10	7.75	*	18.4	--
344	--	-----	88.92	3.22	7.27	.59	12.7	--
321	--	-----	88.83	3.31	7.29	.57	12.7	--
32	--	-----	88.32	3.90	7.78	*	13.4	--
30	95	1.0276	89.22	2.83	7.95	*	11.5	6
348	--	-----	89.21	2.72	7.47	.60	10.3	9
169	--	-----	88.95	2.98	7.46	.61	10.3	--
22	--	-----	88.35	3.53	8.12	*	9.8	--
238	96	1.0278	91.04	1.37	6.98	.61	15.7	54
28	--	-----	89.80	2.41	7.79	*	13.4	20
351	--	-----	89.46	2.44	7.49	.61	10.0	19
346	--	-----	89.40	2.55	7.46	.59	10.6	15
345	--	-----	89.09	2.77	7.51	.64	9.5	7
185	--	-----	89.01	2.96	7.49	.55	10.7	1
18	--	-----	88.78	3.38	7.84	*	12.8	--
294	--	-----	88.64	3.16	7.61	.59	8.9	--
15	--	-----	88.51	3.66	7.83	*	12.7	--
316	--	-----	88.44	3.32	7.61	.63	8.5	--
328	97	1.0281	89.89	1.55	7.92	.64	5.2	48
164	--	-----	89.65	2.49	7.25	.61	12.7	17
317	--	-----	89.57	2.51	7.31	.61	12.0	16
352	--	-----	89.18	2.57	7.63	.62	8.3	21
65	--	-----	89.09	3.19	7.04	.68	14.2	--
293	--	-----	89.08	2.75	7.52	.65	9.2	8
223	--	-----	88.88	3.10	7.40	.62	10.9	--
58	--	-----	88.73	3.06	8.21	*	8.8	--
290	--	-----	88.26	3.36	7.75	.63	6.9	--
162	98	1.0284	89.71	1.82	7.81	.66	5.9	39
147	--	-----	89.55	2.33	7.65	.66	7.7	22
347	--	-----	89.41	2.48	7.50	.61	10.0	17
6	--	-----	89.21	2.25	8.54	*	5.1	25
254	--	-----	89.01	2.95	7.48	.56	10.7	2
240	99	1.0287	90.49	.99	7.88	.64	5.3	67

Number Analysis.	Lactometer At 60° Fahr.	Specific Gravity At 60° Fahr.	Analysis. Water.	Fat.	Casein and Sugar.	Salts.	Added Water.	Cream Removed.
350	--	-----	89.06	2.50	7.83	.64	6.2	17
276	--	-----	88.81	2.67	7.91	.61	5.3	11
298	--	-----	88.49	3.19	7.69	.63	7.6	--
292	--	-----	88.18	3.26	7.95	.61	5.0	--
295	100	1.029	89.42	2.24	7.73	.61	7.3	25
163	--	-----	89.20	2.22	7.92	.66	4.7	26
89	--	-----	89.01	3.40	6.99	.60	15.7	--
247	--	-----	88.94	2.58	7.87	.61	5.8	14
1	--	-----	88.89	2.06	9.05	*	5.0	31
40	--	-----	88.65	3.02	8.33	*	7.5	--
146	--	-----	88.60	3.11	7.68	.61	7.9	--
251	--	-----	88.55	3.09	7.70	.66	7.1	--
208	100	1.029	88.32	3.47	7.60	.61	8.8	--
253	--	-----	88.19	3.23	7.96	.62	4.7	--
100	101	1.0293	88.76	2.78	7.78	.68	†	†
181	--	-----	90.66	1.30	7.41	.63	10.7	57
87	--	-----	89.61	2.18	7.58	.65	8.8	27
83	--	-----	89.14	2.76	7.46	.64	10.0	8
226	--	-----	89.05	2.65	7.70	.70	6.7	12
123	--	-----	88.89	2.92	7.55	.64	9.0	3
55	--	-----	88.80	2.85	8.35	*	7.2	5
299	--	-----	88.18	3.70	7.51	.61	9.8	--
209	102	1.0296	90.24	1.53	7.60	.63	8.3	49
245	--	-----	89.17	2.52	7.76	.55	7.6	16
297	--	-----	88.69	3.10	7.56	.65	8.8	--
246	--	-----	88.55	2.78	8.04	.63	3.7	7
211	--	-----	88.55	3.05	7.76	.64	6.7	--
331	--	-----	88.24	2.65	8.45	.66	§	--
176	103	1.0299	90.26	1.42	7.71	.61	7.6	53
212	--	-----	90.04	1.75	7.62	.59	8.8	42
228	--	-----	89.76	1.83	7.76	.67	5.2	39
36	--	-----	89.06	2.54	8.40	*	6.6	15
74	--	-----	88.15	3.06	8.13	.66	§	--
191	--	-----	87.16	3.74	8.45	.65	§	--
48	104	1.0302	88.54	2.77	8.69	*	†	†
99	--	-----	86.18	4.55	8.60	.67	†	†
72	--	-----	85.45	5.38	8.45	.72	†	†

Number Analysis.	Lactometer At 60° Fahr.	Specific Gravity At 60° Fahr.	Analysis.				Added Water.	Cream Removed.
			Water.	Fat.	Casein and Sugar.	Salts.		
150	104	1.0302	90.54	1.03	7.81	.62	6.3	66
210	--	-----	90.29	1.54	7.77	.60	7.0	48
239	--	-----	89.45	1.77	8.09	.69	2.5	41
318	--	-----	89.25	2.33	7.76	.66	6.5	22
244	--	-----	88.51	2.85	8.05	.59	4.0	5
341	--	-----	88.48	2.53	8.35	.65	?	16
332	--	-----	88.36	2.90	8.07	.67	2.9	3‡
154	--	-----	88.27	3.24	7.80	.69	5.7	--
155	105	1.0305	89.48	1.97	7.96	.59	5.0	34
38	--	-----	89.18	2.04	8.78	*	2.5	32
236	--	-----	88.84	2.82	7.74	.60	7.4	6
282	--	-----	88.68	2.74	8.01	.57	4.2	9
152	--	-----	88.63	2.46	8.38	.63	‡	18
184	--	-----	88.38	2.58	8.43	.61	?	14
233	--	-----	88.38	2.68	8.31	.63	?	10
148	--	-----	88.15	3.29	7.89	.67	4.9	--
304	106	1.0307	87.90	3.41	7.97	.72	†	†
180	--	-----	89.30	1.96	8.05	.69	2.9	35
277	--	-----	88.83	2.46	8.05	.66	3.1	18
230	--	-----	88.79	2.18	8.31	.68	‡	27
227	--	-----	88.37	2.69	8.14	.71	‡	10
101	107	1.0310	88.48	2.75	8.01	.76	†	†
302	--	-----	87.64	3.67	7.98	.71	†	†
93	--	-----	87.48	3.68	8.08	.76	†	†
94	--	-----	87.25	3.84	8.25	.70	†	†
53	--	-----	86.08	4.58	9.34	*	†	†
353	107	1.0310	91.39	1.50	6.51	.60	21.0	50
179	--	-----	90.01	1.31	8.06	.62	3.6	56
214	--	-----	89.38	2.02	7.96	.63	4.6	33
288	--	-----	89.19	2.47	7.72	.62	7.3	18
130	--	-----	89.16	2.22	7.93	.69	4.2	26
243	--	-----	89.00	2.14	8.15	.71	‡	29
123	--	-----	88.71	2.42	8.20	.67	‡	19
280	--	-----	88.52	2.86	8.02	.60	4.2	5
286	--	-----	88.48	3.03	7.88	.61	5.7	--
235	--	-----	88.26	2.36	8.70	.68	‡	21
291	--	-----	88.22	2.61	8.53	.68	‡	13

Number Analysis.	Lactometer At 60° Fahr.	Specific Gravity At 60° Fahr.	Analysis. Water.	Fat.	Casein and Sugar.	Salts.	Added Water.	Cream Removed.
257	108	1.0313	87.65	3.20	8.47	.68	†	†
47	--	-----	87.56	3.16	9.28	*	†	†
95	--	-----	87.12	3.68	8.47	.73	†	†
46	--	-----	85.80	4.43	9.77	*	†	†
337	--	-----	87.72	3.07	8.53	.68	†	§
116	--	-----	89.59	1.71	7.99	.72	3.2	43
221	--	-----	89.58	1.79	8.00	.63	4.2	40
272	--	-----	89.45	1.92	7.98	.65	4.2	36
141	--	-----	89.26	2.03	8.02	.69	3.2	32
82	--	-----	88.55	2.21	8.55	.69	‡	26
120	--	-----	88.43	2.60	8.25	.72	‡	14
220	--	-----	88.40	2.79	8.18	.63	‡	7
279	--	-----	88.26	2.67	8.40	.67	‡	11
39	--	-----	88.19	2.39	9.42	*	‡	20
103	--	-----	88.19	2.84	8.24	.73	‡	5
283	--	-----	87.92	2.95	8.46	.76	‡	2
102	109	1.0316	87.76	3.16	8.40	.68	†	†
96	---	-----	87.54	3.49	8.20	.77	†	†
303	---	-----	87.16	3.76	8.41	.67	†	†
97	---	-----	86.63	3.82	8.80	.75	†	†
156	---	-----	90.01	1.36	7.98	.65	4.2	55
90	---	-----	90.01	1.99	7.31	.69	11.2	34
118	---	-----	89.86	1.42	8.03	.69	3.2	51
142	---	-----	88.86	2.31	8.83	*	‡	23
140	---	-----	88.69	2.64	8.00	.68	3.5	12
165	---	-----	88.64	2.61	8.06	.69	3.1	13
127	---	-----	88.19	2.67	8.44	.70	‡	11
117	---	-----	88.13	2.76	8.40	.71	‡	8
111	---	-----	88.00	2.82	8.45	.73	‡	6
241	---	-----	87.84	2.89	8.54	.73	‡	4
336	110	1.0319	87.85	2.72	8.76	.67	†	§
261	---	-----	84.99	5.14	9.13	.74	†	†
129	---	-----	90.17	1.22	7.91	.70	4.2	59
216	---	-----	89.04	2.09	8.24	.63	‡	30
219	---	-----	88.91	2.14	8.25	.67	‡	29
160	---	-----	88.06	2.23	9.01	.70	‡	22
145	---	-----	88.00	2.88	8.47	.65	‡	4

Number Analysis.	Lactometer At 60° Fahr.	Specific Gravity At 60° Fahr.	Analysis.				Added Water.	Cream Removed.
			Water.	Fat.	Casein and Sugar.	Salts.		
309	111	1.0322	87.96	3.10	8.24	.70	†	†
312	---	-----	87.93	2.89	8.53	.65	†	†
313	---	-----	87.59	3.45	8.29	.67	†	†
255	---	-----	87.58	2.99	8.85	.58	†	†
45	---	-----	87.08	3.63	9.29	*	†	†
59	---	-----	84.23	5.32	9.74	.71	†	†
71	---	-----	89.78	1.38	8.84	*	2.0	54
242	--	-----	89.03	2.17	8.09	.71	2.3	27
232	--	-----	88.85	2.19	8.31	.65	‡	27
285	--	-----	88.68	2.37	8.32	.63	‡	21
229	--	-----	88.66	1.95	8.56	.70	‡	35
151	--	-----	88.62	2.29	8.44	.65	‡	24
5	--	-----	88.48	2.71	8.81	*	2.0	10
250	--	-----	88.21	2.96	8.23	.60	‡	1
54	--	-----	87.90	2.78	9.32	*	‡	7
168	--	-----	87.78	2.91	8.68	.63	§	§
98	112	1.0325	87.34	3.32	8.63	.71	†	†
60	--	-----	86.54	3.58	9.28	.60	†	†
52	--	-----	85.76	4.34	9.90	*	†	†
158	--	-----	91.25	.11	7.92	.72	4.0	96
132	--	-----	89.52	1.56	8.92	*	‡	48
109	--	-----	89.47	1.68	8.16	.69	‡	44
231	--	-----	89.04	1.67	8.59	.70	‡	44
25	--	-----	88.71	2.31	8.98	*	‡	23
21	--	-----	88.32	2.62	9.06	*	‡	12
121	--	-----	88.27	2.54	8.46	.73	‡	17
225	--	-----	87.87	2.58	8.88	.69	‡	14
128	--	-----	87.78	2.93	8.58	.71	‡	2
137	--	-----	87.72	2.96	9.32	*	‡	1
75	--	-----	86.81	3.58	8.92	.69	§	§
167	--	-----	84.27	6.03	9.08	.62	§	§
306	113	1,0328	87.88	2.93	8.51	.67	†	†
311	--	-----	87.82	2.87	8.68	.62	†	†
259	--	-----	87.31	3.46	8.51	.72	†	†
310	--	-----	87.07	3.39	8.91	.63	†	†
215	--	-----	89.33	1.76	8.29	.62	‡	41
174	--	-----	88.82	1.75	8.74	.69	‡	42

Number Analysis.	Lactometer At 60° Fahr.	Specific Gravity At 60° Fahr.	Analysis.				Added Water.	Cream Removed.
			Water.	Fat.	Casein and Sugar.	Salts.		
115	--	-----	88.70	2.13	8.46	.71	‡	29
77	--	-----	88.55	2.18	8.56	.71	‡	27
319	--	-----	88.26	2.51	8.57	.66	‡	16
133	--	-----	88.25	2.41	9.34	*	‡	20
202	--	-----	88.24	2.60	9.16	*	‡	13
80	--	-----	88.23	2.94	8.08	.75	‡	2
144	--	-----	87.86	2.84	8.66	.64	‡	5
49	114	1.0331	87.66	2.81	9.53	*	†	†
314	--	-----	87.50	3.01	8.76	.73	†	†
50	--	-----	87.47	3.01	9.52	*	†	†
305	--	-----	87.35	3.42	8.55	.68	†	†
44	--	-----	87.06	3.27	9.67	*	†	†
260	--	-----	86.55	3.88	8.91	.66	†	†
122	--	-----	90.48	.55	8.30	.67	‡	82
84	--	-----	89.49	1.48	8.29	.74	‡	51
78	--	-----	88.76	2.14	8.47	.63	‡	29
85	--	-----	88.54	2.35	8.37	.74	‡	22
269	--	-----	88.53	2.96	7.87	.64	5.5	1
287	--	-----	88.41	2.72	8.21	.65	‡	9
270	--	-----	88.03	2.84	8.48	.65	‡	5
131	114	1.0331	87.53	2.70	9.77	*	‡	10
166	--	-----	86.08	3.96	9.24	.72	§	§
301	115	1.0334	88.36	2.74	8.19	.71	†	†
258	--	-----	86.83	3.71	8.77	.68	†	†
338	--	-----	86.69	3.18	9.47	.66	†	§
339	--	-----	86.12	3.64	9.59	.65	†	§
217	--	-----	90.26	.29	8.81	.65	‡	90
262	--	-----	90.16	.92	8.27	.65	‡	69
263	--	-----	88.55	2.21	8.56	.68	‡	26
7	--	-----	87.81	2.60	9.59	*	‡	13
105	116	1.0336	90.85	.27	8.14	.74	‡	91
113	--	-----	89.58	1.18	8.52	.72	‡	61
112	--	-----	89.21	1.36	8.71	.72	‡	55
73	--	-----	88.97	1.64	8.69	.70	‡	45
354	--	-----	88.81	1.36	9.17	.66	‡	55
273	--	-----	88.61	1.86	8.84	.69	‡	37
66	--	-----	88.54	1.99	9.47	*	‡	34

Number Analysis.	Lactometer At 60° Fahr.	Specific Gravity At 60° Fahr.	Analysis. Water.	Fat.	Casein and Sugar.	Salts.	Added Water.	Cream Removed.
76	--	-----	88.10	2.48	8.71	.71	‡	17
264	--	-----	88.06	2.79	8.46	.69	‡	7
79	--	-----	87.90	2.61	8.76	.73	‡	13
307	117	1.0339	86.91	3.65	8.74	.70	†	†
256	--	-----	86.28	4.19	8.88	.65	†	†
119	--	-----	90.55	.06	8.70	.69	‡	98
110	--	-----	89.86	.71	8.74	.69	‡	76
159	118	1.0342	90.70	.08	8.50	.72	‡	97
24	--	-----	90.69	.51	8.80	*	‡	83
281	--	-----	90.23	.49	8.59	.69	‡	84
34	--	-----	88.78	1.83	9.39	*	‡	39
355	--	-----	88.23	1.94	9.17	.66	‡	35
266	--	-----	88.12	2.54	8.61	.73	‡	15
43	119	1.0345	86.87	3.29	9.84	*	†	†
26	--	-----	90.73	.18	9.09	*	‡	94
218	--	-----	90.38	.06	8.89	.68	‡	98
10	--	-----	88.62	1.87	9.51	*	‡	38
224	--	-----	88.53	2.14	8.66	.70	‡	29
92	--	-----	86.91	2.13	10.21	.75	‡	29
356	121	1.0341	89.65	.26	9.47	.62	‡	91
357	--	-----	89.46	.49	9.39	.66	‡	84
265	126	1.0365	89.61	.55	9.11	.73	‡	82

The percentages of water added and cream removed in the preceding analyses were calculated from the standards of the States of New York and New Jersey, namely, over 9 per cent. of solids, not fat, over 3 per cent. of fat, and less than 88 per cent. of water. For details with regard to the samples taken from cows which were seen milked, and the names of owners of some of the samples of adulterated milk, see Report on Fresh and Condensed Milk in the Fourth Annual Report (1883-4) of the New York State Board of Health.

In conclusion: The lactometer is an accurate instrument for taking the specific gravity of milk. The specific gravity of the entire quantity of milk given by a healthy cow at her regular time of milking is rarely, if ever, below 1.029. The specific gravity of pure milk increases with the quality, that is, with the decreased percentage of water; while it decreases in proportion to the water added and increases with the cream removed, either or both adulterations being apparent to the senses of an expert. If the test is performed by an expert, it is impossible to tamper with a sample of milk, to the extent of commercial adulteration, without being detected by the specific gravity taken in connection with evidence of the senses.

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NOTES ON THE MORPHIOMETRIC ASSAY OF OPIUM.

BY JOSEPH F. GEISLER, PH. G.*

The recent discussions in pharmaceutical journals on the subject of the morphiometric assay of opium have attracted much attention. Inasmuch as the medicinal virtues of opium depend principally upon the percentage of morphine, it is of the utmost importance to the profession to know the exact quantity of morphine in a given specimen of opium or its preparation. Most of the methods for the morphiometric assay of opium may be classified under two general heads. Those using water simply, as a solvent, and those using lime. Each class has merits of its own under certain conditions, but it is an established fact that the two classes will not work equally well on opiums of all grades and varieties. Experience is required to get the best results by any method, and strict adherence to details contributes much to a correct and successful assay.

This paper will be confined principally to the analytical discussion of some of the theoretical and actual errors of the U. S. P. method for the assay of opium adopted in the Pharmacopœia of 1880.

For the benefit of those not familiar with the method, the details are given herewith :

"Opium in any condition to be valued, seven grms. (7), lime, freshly slacked, three grms. (3), ammonium chloride, three grms. (3), alcohol [Sp. Gr. 0.820], stronger ether [Sp. Gr. 0.725], distilled water, each a sufficient quantity. Triturate together the opium, lime and 20 c.c. of distilled water in a mortar, until a uniform mixture results ; then add 50 c.c. of distilled water, and stir occasionally during half an hour. Filter the mixture through a

* Read at the meeting of the American Pharmaceutical Association, Detroit, Sept. 3-7, 1888.

plaited filter, three to three and one-half inches in diameter, into a wide-mouthed bottle or stoppered flask (having the capacity of about 120 c.c., and marked at exactly 50 c.c.) until the filtrate reaches this mark. To the filtered liquid (representing 5 grms. of opium) add 5 c.c. of alcohol and 25 c.c. of ether, and shake the mixture, then add the ammonium chloride, shake well and frequently during half an hour, and set it aside for twelve hours. Counterbalance two small filters, place one within the other in a small funnel, and decant the ethereal layer as completely as practicable upon the filter. Add 10 c.c. of stronger ether to the contents of the bottle and rotate it, again decant the ethereal layer upon the filter, and afterward wash the latter with 5 c.c. of stronger ether, added slowly and in portions. Now let the filter dry in the air, and pour upon it the liquid in the bottle, in portions, in such a way as to transfer the greater portion of the crystals to the filter. Wash the bottle and transfer the remaining crystals to the filter with several small portions of distilled water, using not much more than 10 c.c. in all, and distributing the portions evenly upon the filter. Allow the filter to drain, and dry it, first by pressing it between sheets of bibulous paper, and afterward at a temperature between 55° and 60° C. Weigh the crystals in the inner filter, counterbalancing by the outer. The weight of the crystals in grms., multiplied by twenty (20) equals the percentage of morphine in the opium taken."

The queries which suggest themselves concerning this method are:

1. Does the lime treatment extract all the morphine?
2. Does the aliquot part (50 c.c.) of the filtrate represent the proportional equivalent of 5 grams of opium?
3. Is all the morphine recovered from the aliquot part taken?
4. What is the purity and character of the crystals obtained?

The first of these queries, time did not permit me to investigate sufficiently to present reliable analytical data.

The second query has been subjected to analytical inquiry by a number of careful investigators. The question, however, is still a disputed one. To solve this question the following experiments were undertaken, with results as indicated below.

Theoretically the volume of the solution of the opium assay will

be affected by the quantity of the soluble matter in the opium taken. It is safe to say that each grm. of water in the opium taken will increase the volume of the added water by one (1) c.c., so that opium of different degrees of moisture will, from this source alone, affect the volume of the solution according to the percentage of moisture in the sample taken. Secondly, the volume will be further affected by the quantity of the soluble matter of the opium, other than water. Opium as a rule contains from sixty (60) to sixty-five (65) per cent. of soluble matter, but the solution of much of this is prevented by the lime and the limited quantity of water. The soluble solids of opium which go into solution will have a tendency to increase the volume of the solution by about 60 to 63 per cent. of their weight. It seems therefore, from theoretical deductions, that 50 c.c. of the filtrate will seldom represent exactly 5 grms. of opium.

To demonstrate this, two samples of opium, A and B, containing respectively 8.0 per cent. and 7.13 per cent. of moisture, were submitted to assay under the following conditions: Into a tared Erlenmayer flask containing a weighed, rubber-tipped glass rod, 7 grms. of opium were placed, followed by 3 grms. of freshly slaked lime (3 pts. lime to 1 pt. of water) and 70 c.c. of water. The weight of the whole was accurately noted. The contents of the flask were then thoroughly mixed and stirred during one hour. This is somewhat longer than the U. S. P. method directs. It is not always practical to stop the maceration at the end of half an hour, so that this deviation, though slight, must be taken into account, although it may not cause any practical difference in the results. The maceration in the flask was adopted to avoid loss by evaporation, which from an open mortar is often quite considerable, as was verified by direct weighings. On completion of the maceration, the magma was filtered through a filter paper, the weight of which, with the funnel, was previously noted. Precautions were taken to avoid evaporation during the filtration. A little over fifty c.c. were collected in a tared flask and the weight of the whole immediately taken. The residuum on the filter, with the filter, funnel, flask and glass rod, was dried at 100° C., and the increase in weight noted. A portion of the collected filtrate was evaporated, the residue dried at 100° C., and the quan-

tity of solids and water determined, from which data the relative volumes were calculated.

The following are the analytical data:

Opium A, containing 8 per cent., moisture.

Flask + rod	= 43.385 g.	+ residuum dried at 100° C =	93.330
Funnel	= 41.050 g.	tare =	85.319
Dried filter	= .884 g.		
Total tare	.85.319	Solids in residuum =	8.011

Total weight of filtrate collected=52.841 grms. of Sp. Gr. 1.0173 at 15.5° C. Hence volume of collected filtrate=51.942 c. c.

Total weight of material taken, 7 grms. of opium+3 grms. slaked lime+70 c.c. water=80 grms., 80.000 grms.—52.841=27.159 grms., total weight of residuum on filter.

27.159 grms. residuum on filter—8.011 grms. solids=19.148 grms. water in same.

Of the collected filtrate 8.6027 grms. evaporated and dried at 100° C. gave .3077 grms. solids, whence the difference=8.295 grms. water. The weight of water in the 52.841 grms. (=51.942 c.c.) of collected filtrate is therefore 50.9509 grms. water. From these data the total volume of the liquid may be calculated by the equation $a : b :: (a+d) : x$, in which a is the weight of the water in the collected filtrate, b the volume of the same, and d the weight of water in the residuum. 50.9509 : 51.942 : : (50.9509+19.148) : x=71.46 c.c., total volume of the solution.

Opium B=7.13 per cent. moisture.

Flask, funnel, rod, paper=85.064 grms.,+residuum dried at 100° C=93.120 grms.=8.056 grms. solids in residuum.

Weight of filtrate collected=52.540 grms., Sp. Gr. at 15.5° C. 1.0178 =51.629 c.c., volume of collected filtrate. 80.000—52.549 =27.451 total residuum on filter—8.056 grms. solids=19.395 grms. water.

9.1125 grms. filtrate dried at 100° C.=.3385 grms. solids, hence difference=8.7740 grms. water, whence 50.596 grms. water in filtrate collected.

50.596 : 51.629 : : (50.596+19.395) : x=71.419 c.c. total volume of solution.

It is thus seen that the 70 c.c. of added water were increased in

volume to 71.46 and 71.41 c.c. respectively in the two assays. It will be noticed that in the above calculation it is taken for granted that the character of the filtrate is the same as the liquid portion remaining in the residuum on the filter, that is, equal volumes of each will contain the same quantity of soluble solids. This point is disputed by some. I have, however, not seen any data which will support the objection, and which are not open to criticism. Further, no account is taken of any decomposition during drying. What these experimental errors would amount to it is difficult to say. They would, however, not materially alter the conclusion to be drawn from the above data, which are given in sufficient detail to be available for correction in case any error appears in the modus operandi adopted.

It is shown, therefore, that in these assays 50 c.c. of filtrate represented less than 5 grms. of opium, the actual quantities being 4.897 and 4.9 grms., causing a loss in the assay of .25 and .24 per cent. morphine respectively, in an opium assaying 12 per cent. morphine.

The third of the above queries is readily answered. It is not to be supposed that all the morphine can be recovered in a pure state by a single crystallization from such a complex solution as the concentrated infusion of opium. The object, therefore, is to produce the morphine in as pure a condition as possible, so as to avoid unnecessary after treatment, and it becomes a question whether the impurities contained in the weighed morphine counterbalance the morphine lost in the crystallization and subsequent treatment. Some of the older methods weighed morphine of a notoriously impure character.

In the U. S. P. method, the yield of the morphine is affected by the quantity of alcohol and calcium and ammonium chloride contained in the crystallizing liquid. To decrease the solvent power of these, ether is added as an anti-solvent, as well as for facilitating a pure precipitation of morphine.

To illustrate how different quantities of lime and ammonium chloride affect the results, the following two assays were conducted by the U. S. P. method, using .600 grms. of pure, crystallized (finely pulverized) morphine in place of opium.

ASSAY A.

.600 grms. morphine with lime and NH_4Cl by U. S. P. method. Yield of morphine=.360 grms. ÷ .4285 (equivalent for 50 c. c.) =84.01 per cent. morphine recovered by assay.

ASSAY B.

.600 grms. morphine, 1.5 grms. slaked lime, and .8 grms. NH_4Cl by U. S. P. method. Yield of morphine =.3935 grms.=91.83 per cent. recovered.

Hence in A the loss of morphine was 15.99 per cent., while in B, with lime and NH_4Cl decreased, the loss amounted to only—8.17 per cent.

In opium, however, this vast loss of morphine is, to a considerable extent, decreased by the presence of the soluble matter extracted from the opium.

The principal loss of morphine is that in the mother liquors, as will futher be seen from the assays of an opium which gave exceptionally low results by the U. S. P. method.

Opium "O"=5.35 per cent. moisture.

No. 43. U. S. P. method.	a. 10.48 per cent. morphine	} average 10.525 per cent.
No. 44. U. S. P. "	b. 10.57 " " "	
No. 40. U. S. P. modified	c. 11.38 " " "	
No. 41. U. S. P. "	d. 11.14 " " "	

The modification in 40 and 41 consisted in using only 1.5 g. lime and .8 g. NH_4Cl with the quantity of alcohol also decreased to 3 c.c. in No. 40 and 4 c.c. in No. 41. The influence in the quantity of alcohol used is quite perceptible here, a difference of 1 c.c. alcohol having caused a difference of .24 per cent. morphine in the assays, while the influence of the smaller quantities of lime and NH_4Cl is still more marked, the percentage of morphine having been increased .62 and .86 per cent. over the U. S. P. average. The crystals in each of these four assays were exceptionally pure and white, dissolving completely to a clear solution in officinal lime water. The filtrates of the U. S. P. assays No. 43 and No. 44, with the ether and other washings from the assays, were combined, the whole therefore representing 10 grms. opium.

The combined solutions, after acidulating, were concentrated on

the water-bath to remove the alcohol and ether, and finally exhausted with ether, as long as the same removed coloring and other matter. The ether washings were reserved. The water solution was then futher treated with several washings of amyl alcohol the latter with the reserved ether washings thoroughly washed with acidulated water, and the water washings concentrated and added to the main bulk. Amyl alcohol was again added, the solution made alkaline with an excess of ammonium hydrate, and the extraction continued to exhaustion. The amyl alcohol extracts were first washed with water, and then with water containing a slight excess of hydrochloric acid, so that the water washings were acid in reaction. This acid water solution containing all the alkaloid was evaporated twice on the water-bath to remove the amyl alcohol and excess of hydrochloric acid. It was then transferred to a crystallizing flask and diluted to 7 c.c., 5 c.c. of alcohol were now added, together with 20 c.c.; of ether, followed by 1.25 c.c. of 10 per cent. ammonia. The whole was thoroughly shaken and allowed to crystallize for 48 hours. The resulting crystals were washed with "morphiated spirit," "morphiated water," and finally benzol, and were comparatively pure. The crystals weighed .1033 grms., indicating 1.033 per cent. morphine which was lost in the U. S. P. assays, No. 43 and 44. All the morphine, however, was not recovered by the above treatment, for the percentage of morphine in opium "O" as determined by three other methods of assay, each performed in duplicate, and all agreeing very closely, was found to be 12.32 per cent., so that in this opium the U. S. P. method yielded 1.795 per cent. less than the true quantity of morphine contained therein. The opium, it will be observed, was quite dry, and it is possible that this may have influenced the results ; but for all the confirmatory assays the opium was used in the same condition as to percentage of moisture. The yield and purity of crystals is affected decidedly if the crystals on the filters are not first thoroughly dried between bibulous papers. To accomplish this readily it is expedient to compress the filter papers containing the crystals, places them between two pieces of blotting or filter paper, and then press thoroughly between toweling until all excess of moisture has been expressed, as determined by observing whether the filters when compressed be-

tween fresh blotting or filter paper, dampen the same. This also facilitates the drying.

The losses of morphine in the U. S. P. assays of opium "0" were exceptionally large. Two other varieties of gum opium gave much better results.

Opium	A.	B.
U. S. P. method	11.60 per cent. morph.	12.94 per cent. morph.
U. S. P. modified	11.35 " " "	13.12 " " "

Opium	C.—8.0 per cent. moist.	D.—7.13 per cent. moist.
U. S. P. method	11.82 per cent. morph.	13.89 per cent. morph.
U. S. P. modified	12.30 " " "	14.36 " " "

The opium C and D, assayed by Stillwell's modification of Squibb's method, yielded 12.31 per cent. and 14.70 per cent. morphine respectively, so that in C the deficiency amounted to .49 per cent. and in D to .81 per cent. by the U. S. P. method, while in the modification (see assays No. 40 and 41 of opium "0" above) the results were much closer, C. showing a deficiency of only .01 per cent. and D a loss of .24 per cent. These assays are certainly instructive in demonstrating how differently different varieties of opium work with the U. S. P. method.

PURITY AND CHARACTER OF THE CRYSTALS.

In a properly conducted assay the U. S. P. crystals are certainly exceptionally pure. An average lot of morphine, yielded by the U. S. P. method from different varieties of opium and laudanum, gave but little residue when treated with lime water, and by titration with oxalic acid, standardized on pure morphine, the purity of the crystals was found to be 96.94 per cent. As a rule the crystals are purer than this. I have frequently found them 98.0 to 99.8 per cent. pure, as indicated by titration with standardized oxalic acid.

Several investigators have lately called attention to the loss of water of crystallization of morphine when dried at 100° C. The U. S. P. directs the crystals to be dried at not over 60° C. Experience teaches that that temperature should not be much exceeded. In methods directing the crystals to be dried at 100° C. it frequently happens that partly dehydrated crystals are

weighed. Pure crystallized morphine, $C_{17}H_{19}NO_3H_2O$ contains 5.94 per cent. of water of crystallization.

Some pure morphine was prepared from commercial "pure morphine" by subjectiong the latter to the following treatment; ½ oz. of crytals were finely pulverized, washed with "morphiated spirits," dried, then washed with repeated portions of benzol, the crystals then dissolved in water (q.s.,) acidulated with hydrochloric acid, the whole diluted to 100 c.c., and 5 c.c. of alcohol and finally 5 c.c. of water of ammonia added, the whole shaken and allowed to crystallize, transferred to a filter, and washed with water until free from chlorine and ammonia; the crystals were then compressed between bibulous paper and finally dried at 56° C. to constant weight. 92.3 per cent. of the quantity taken were recovered.

The crystals thus prepared, when dried in an open air bath at 100° C., lost all their water of crystallization in four hours. The loss amounted to 6.081 per cent. or .141 per cent. in excess of 5.94 per cent., the true amount of pure crystals.

The U. S. P. crystals of morphine contain rather more water than this, as will be seen from the following nine determinations, representing morphine from as many different U. S. P. assays. The crystals in each case were dried at 100° C. to constant weight. Most of the crystals lost all their water of crystallization in 4 hours, while a few suffered a slight further loss by 5 to 8 hours longer drying at the above temperature. The total loss in weight for the respective lots was 6.83 per cent., 6.88 per cent., 6.75 per cent., 6.73 per cent., 6.51 per cent., 6.83 per cent,, 6.93 per cent., 6.86 per cent., 6.81 per cent., which is an average of 6.79 per cent. water in the U. S. P. crystals. Neither any of these crystals, nor the sample of pure morphine, suffered any further loss by drying at 120° C. for 3 hours, thus demonstrating that all the water of crystallization is lost at 100° C., by from 4 to 12 hours drying.

When the U. S. P. assay is properly conducted, the crystals seldom contain over 4 per cent. of impurities.

It is evident from the data obtained, that with some opiums the U. S. P. method gives results considerably below the truth, and although the results are uniform, duplicates agreeing well with each other, the results cannot always be relied upon as giving the true percentage of morphine in an opium.

PROVISIONAL LIST OF ABBREVIATIONS OF TITLES OF CHEMICAL JOURNALS.*

The numbers refer to the Catalogue of Chemical Periodicals by H. Carrington Bolton, New York, 1885, 8vo. Titles 183–196 in the Supplement, New York, 1887 [Nos. 15 and 19 of the preceding list].

1. Afh. Fys. Kemi.
2. Agenda chim.
3. Chem. Ztg.
4. Allg. chem. Bibl. (Trommsd.)
5. Allg. J. Chem. Scherer.
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* This list, from the report of the Committee on Indexing Chemical Literature (Proceedings of the American Association for the Advancement of Science, Vol. XXXVI.) is published for the benefit of members, and for the guidance of abstractors for the Journal; it will be adhered to in future in the publications of the Society.—Ed.

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179. Ztschr. chem. Grossgew.
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184. Bull. Chem. Soc. Washington.
185. Chemiker u. Drogist.
186. Chem.-techn. Centrlanz.
187. Deutsche Chem.-Ztg.
188. J. Anal. Chem.
189. Meddel. Carlsberg Lab.
190. N. Y. Analyst.
  a Am. Analyst.
191. Sknd. Kem. Centrlblad.
192. Suppl. enciclop. chim.
193. Tokyo K. Kaishi.
194. Vjschr. Chem. Nahr.
195. Ztschr. Chem. Ind.
196. Ztschr. phys. Chem.

Am. J. Sci.
Arch. sc. phys.
Jen. Ztschr.
Sitzb. Akad. Berlin,
Sitzb. Akad. Wien.
Phil. Trans. Lond.
Proc. Roy. Soc.
Proc. Am. Acad.
Ann. N. Y. Acad. Sci.
Proc. Acad. Nat. Sci. Phil.

The number of Society Transactions publishing chemical papers is very great, and the list (added at the suggestion of some members of the committee) could be greatly extended.

SALEM PRESS, October, 1887.

ABSTRACTS.

GENERAL AND INORGANIC CHEMISTRY.

Molecular Weight of Iodine in its Solutions. MORRIS LOEB.

The fact is recalled that iodine dissolves with different colors in different liquids. For instance, the solution in ether is deep reddish brown, and that in carbon di-sulphide is pure violet. Obtaining, by an apparatus of special construction, the difference between the vapor-tension of the pure solvent, and that of the iodine solution; the author establishes a formula, giving a molecular weight for iodine corresponding to I_4 for its red solutions, and a value between I_2 and I_3 for those of violet color. (*J. Chem. Soc.*, **53**, *805*.) W. P. M.

ANALYTICAL CHEMISTRY.

Determination of Sulphur in Coke. By L. BLUM.

The author found, on comparing different methods for the determination of sulphur in coke, that the fusion method was the only one giving reliable results. The finely pulverized coke should be fused with a mixture of 16 parts NaCl, 8 parts KNO_3, 4 parts Na_2CO_3, and the mass, after fusion, dissolved in water, etc., the sulphur being weighed as barium sulphate.

Oxidation of the sulphur in the coke by potassium chlorate and hydrochloric acid or bromine in hydrochloric acid, yielded only about 20—25 per cent. of the true per cent. of sulphur. (*Zeit. anal. Chem.*, **27**, *pp. 445-452.*) J. F. G.

Determination of Carbon in Iron. DR. L. L. DE KONINCK.

To obviate any error arising from the possible generation of chlorine during oxidation with chromic acid in the carbon deter-

mination according to the McCreath-Ulgren method, the author recommends the addition of a small quantity of silver sulphate. (*Zeit. anal. Chem.*, **27**, *p. 464*), J. F. G.

New Mixture for Separating Carbon from Pig-iron, Steel, etc. T. W. Hogg.

The usual method of procedure occasionally allows the precipitation of the somewhat insoluble cuprous chloride with the separated carbon.

To prevent this precipitation, advantage is taken of the reaction

$$Fe_2Cl_6+Cu_2Cl_2=2FeCl_2+2CuCl_2.$$

The weighed metal is placed in a beaker, covered with half an inch of $CuCl_2$ solution (Sp. Gr. 1.35), and then a considerable excess of Fe_2Cl_6 solution (Sp. Gr. 1.30) is added. After five minutes stirring, heat is gently applied up to the boiling point. Decomposition is complete in twenty minutes. Precipitation of basic compounds is prevented by addition of a few drops of HCl, and the carbonaceous residue is filtered off. (*Chem. News*, 58, *199.*) W. P. M.

Qualitative Separation of Gold and Platinum from Arsenic, Antimony and Tin. By Dr. L. L. de Koninck and Dr. A. Lecremier.

The moist sulphides of the metals contained in a small porcelain vessel, which is placed in a glass tube of 30 cm. length, are heated while subjected to a stream of hydrochloric acid gas, generated by the action of sulphuric acid upon solid ammonium chloride. The antimony and tin rapidly volatilize as chlorides and the arsenic as sulphide, leaving the gold and platinum in the residue. (*Zeit. anal. Chem.*, **27**, *pp. 463.*) J. F. G.

Use of Aniline as an Absorbent of Cyanogen in Gas Analysis. Morris Loeb.

Cyanogen is readily absorbed by aniline with formation of HCN. The prescence of CO_2 causes an evolution of the HCN present, at the same time a portion of the CO_2 passes into solution. Carbon monoxide acts in like manner.

As the above gases are those which usually accompany cyanogen,

the use of aniline as an absorbent is not practicable. (*J. Chem. Soc.*, **53**, *812.*) W. P. M.

Chemical Examination of Gums and Resins. ROWLAND WILLIAMS.

Eighteen different kinds were examined, and percentage determined of : Potash absorption ; Saponification equivalent ; Iodine absorbed ; Loss on drying ; Mineral matter.

The results are tabulated. (*Chem. News*, **58**, *224.*) W. P. M.

Specific Gravity, at 100° F., of Fat when Clear, and also when Clouded with Crystals. E. W. T. JONES.

Lard was melted until quite clear, and then the temperature was allowed to fall to 100° F. At this temperature the clear fat gave a specific gravity of 905.87. The melted fat was then maintained at 100° F. for some hours until clouded with crystals. On again taking the specific gravity the result was 910.49. The determinations were made with the gravity bottle. (*Analyst*, **13**, *201.*)

W. P. M.

Determination of Fat in Oil Cake. By R. KLOPSCH.

The drying of linseed oil cake should be limited to three hours and conducted on the water bath. Ether will then readily extract the oil, and on evaporation leave it as a residue having a yellowish green color, whereas, if overheated while drying, the oil residue has a more or less brownish color.

Drying at temperatures over 100° C, and even at lower temperatures for too long a time, seems to oxidize some of the oil and render it insoluble in ether. (*Zeit. anal. Chem.*, **27**, *pp. 452–457.*)

J. F. G.

The Chemical Character of Peptones and the Separation of Pure Albumen from the same. By R. PALM.

Peptone is the result of the action of lactic acid upon egg, milk, ser-albumen, or casien, and further, peptones are similarly produced from gelatin, fibrin, and chondrin. Peptone is a solution of protein in lactic acid. By adding ether to an alcoholic solution of peptone, a peptone of uniform composition is separated as an oily mass containing protein and lactic acid in exact stoichometric proportions. Vice versa, pure albumen can be separated from peptone after neutralizing the lactic acid of the peptone solution

by ammonia, and adding an excess of 95 per cent. alcohol, whereby all the albumen is precipitated.

Alcohol acidulated with sulphuric acid will also precipitate the albumen, if the sulphuric acid is not in too large excess.

The author found that when a peptone solution was neutralized by ammonia, all the albumen reagents gave the reactions characteristic of pure normal albumen, and that the albumen was also coagulable by heat.

Peptone, as a result of digestion, may contain lactic and hydrochloric acid. From a solution of peptone the coagulation of the albumen by heat, or precipitation by alcohol, is prevented by the presence of the lactic acid.

Peptone reduces an alkaline copper solution as readily as milk sugar. Although peptone is a solution of protein (albumen) in lactic acid, the term is also applicable to solutions of protein in other acids such as hydrochloric, sulphuric and acetic acid.

To distinguish albumen from peptone potassium xanthogenate may be used, as it precipitates solutions of peptone at once, and normal solutions of albumen only after acidulation. (*Zeit. anal. Chem.*, **27**, *359–363.*) J. F. G.

INDUSTRIAL CHEMISTRY.

Ancient Mortars. A. Irving.

The presence of nearly eleven per cent. of soluble silica in mortar from the Roman wall of London, and in that from the Roman bath at Bath, suggests the possibility of the synthesis of calcium silicate by saturation of the ingredients with water, during a long space of time ; but it seems far more likely that the soluble silica occurred in the form of easily decomposible silicates, which are found, in a more or less vitreous condition, in the pumiceous tuffs, which are extensively worked for "hydraulic mortar." That the Romans were familiar with such a use of the material in question we known from the writings of Strabo. (*Chem. News*, **58**, *219.*)

W. P. M.

The Tees Salt Industry. T. W. STUART.

A full description as to history, mode of working, analyses of products and general statistics.

The paper is very fully illustrated. (*J. Soc. Chem. Ind.*, **7**, *660.*) W. P. M.

Influence of Silicon on the Properties of Iron and Steel. THOMAS TURNER.

The authors conclusions derived from extended and tabulated experiments, are:

"Ingot iron containing silicon in all proportions up to 0.5 per cent. (and with about 0.5 per cent of manganese) rolls well, and does not show any signs of red-shortness; it welds perfectly with all proportions of silicon, and, with the somewhat doubtful exception of the 0.5 per cent. specimen, is not brittle when cold. With less than about 0.15 per cent. of silicon, the limit of elasticity, the breaking load, the extension, and the reduction of area, are but little, if at all, affected by the proportion of silicon present.

The fracture, though not much altered, shows rather greater tendency to a crystalline or granular appearance. With upward of 0.15 per cent. of silicon, the limit of elasticity and breaking load are increased, though the effect of silicon in this respect is not nearly so marked as that of carbon. The reduction of area and extension (that is the ductility) are distinctly reduced, and rendered more irregular by the presence of much silicon. The fracture is also rendered more granular or crystalline, and is less regular in character." (*J. Chem. Soc.*, **53**, *844.*) W. P. M.

A Collection of Specific Gravities Tables. By Dr. G. T. GERLACH.

A very thorough collection of tables of specific gravities of aqueous solutions, based on the latest researches. (*Zeit. anal. Chem.*, **27**, pp. 269-358.) J. F. G.

Abstracts of American Patents Relating to Chemistry.

]*From the Official Bulletin of the U. S. Patent Office.*]

June 12th, 1888.

384,815.—Manufacture of dye stuffs. M. Herzberg.

New brown dye stuffs, prepared by combining the salts of diazo compounds of aniline, toluidine, xylidine, cumidine and the nitroderivatives of the same, amidoazobenzene, amidoazotoluene, amidoazoxylene, alpha and beta naphthylamine, or their sulpho and carboxylic acids, and tetrazo compounds of benzidine, benzidine sulpho acid, tolidine, diamidostilbene, or their sulpho or carboxylic acids with bismark brown (triamidoazobenzene or triamidoazotoluene. The above insoluble colors are rendered soluble in water by a sulphonating process.

384,816.—Manufacture of dye stuffs. M. Herzberg.

384,842.—New coloring matter obtained by the action of tetrazo-diamido benzene on phenols. R. G. Williams.

The coloring matters are obtained by the action of tetrazo-diamido-benzene (hydrochloride) or its homologues on resorcinol, the phenols, benzoic, the oxybenzoic acids and alpha naphthol, or their substitution products, on aniline and its homologues, beta naphthol and the naphthylamines, or their substitution products, and on the sulpho-acids of the above amines, amides and phenols, or their substitution products.

384,858.—Producing dried extract of rennet. F. Graeff.

Liquid extract of rennet is evaporated to dryness in vacuo at a temperature not exceeding 40°, after which it is comminuted, washed with a saturated solution of salt and dried.

384,480.—Production of blue coloring matter. E. Ullrich.

Methylene blue is prepared by subjecting paramido-dimethylaniline, dimethylaniline, hydrochloride and sodium hyposulphite to the action of an oxidizing agent, as bichromate and heat. W. R.

JOURNAL

OF THE

AMERICAN CHEMICAL SOCIETY.

VOL. X.–NO. 8.

OCTOBER,

1888.

COMMITTEE ON PAPERS AND PUBLICATIONS:

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ABSTRACTORS:

W. RUPP, M. LIEBSCHÜTZ,
J. F. GEISLER, W. P. MASON.

CONTENTS:

PUBLISHED MONTHLY.

NEW YORK:
JOHN POLHEMUS,
102 Nassau Street.
1888.

The Journal of the American Chemical Society appears monthly, except during July and August. It will contain all papers read before the Society, as well as abstracts from American and Foreign Journals, and a list of American Patents relating to Chemical Industries.

The Price of Subscription is $5.00 per year, in advance.

The Meeting Room and Library of the Society are at Room 1, University Building, Washington Square, New York.

The Regular Monthly Meeting is held on the first Friday of every month, at 8 P. M.

Corresponding Secretary:

M. ALSBERG, 54 Maiden Lane, New York.

Treasurer:

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The Library will be open to Members regularly on Fridays, from 6 to 10 P. M., and at any other time on presenting to the Janitor of the University Building a ticket, which can be obtained of the Librarian.

Back numbers of the Journal are sold to Members at $3.00, to others at $5.00, per volume. Apply to the Librarian

WILLIAM RUPP, 97 Water St., New York.

The Committee on Papers and Publications respectfully call attention to the resolutions of the Society requiring that papers be submitted to the Committee before being read.

Authors will be furnished, gratis, with 20 reprints of each article published in the Journal, if application for the same be made when the article is sent.

Members are requested to give notice of any change of address, or failure in the delivery of the Journal. All communications relating to the Journal should be addressed to the Editor.

A. A. BRENEMAN, 97 Water St., New York.

REGULAR MEETING, October 4th, 1888.

Vice-President Waller in the Chair.

The minutes of the June meeting were read and approved.

Prof. Breneman reported for the Board of Directors that a committee had been appointed to consider the question of an Endowment Fund for the Society.

The following gentlemen were proposed for membership:

E. DWIGHT KENDALL, 58 Bainbridge street, Brooklyn, N. Y.

H. P. CURTIS, Zylonite, Mass.

Messrs. Breneman, Stebbins and O'Connor were elected as Nominating Committee for the Annual election.

The meeting was then adjourned.

T. D. O'CONNOR,

Recording Secretary.

TWO COMMUNICATIONS.

BY L. H. FRIEDBURG, PH.D.

I.—On a New Fat Extractor for Laboratories, by J. Graftiau, of Gembloux.

II.—On Curtius' Hydrazin.*

I.

My friend, Prof. A. Peterman, of Gembloux, Belgium, sent me a report on a new fat extractor, used in his laboratory and constructed by one of his assistants. Since I find it original and valuable enough to be described here, I do not hesitate to do so, hoping that some chemist may find it useful in his special work. I remark, that this apparatus has meanwhile been described in the November number of the Philadelphia *Textile Colorist,* from which this description is taken; it is reproduced here, as it may reach, through this journal, a different class of chemists who may wish to use it.

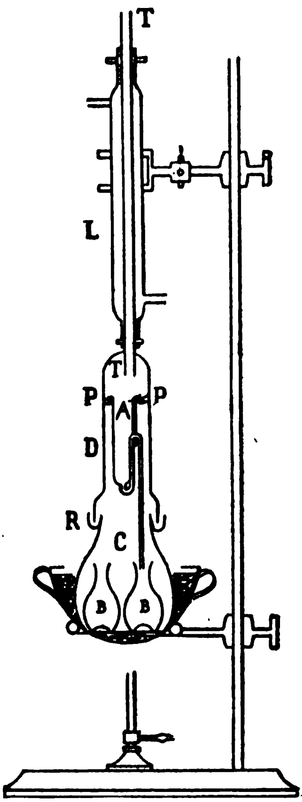
The different well known extractors for the analytical determination of fats and oils need not be enumerated here. The new one claims mainly two advantages over the others, particularly over those of Soxhlet and of Petermann and Simon. They are:

1st. No corks are used from which the solvent eventually extracts substances which would add to the weight of the fat in the sample to be extracted.

2d. At the end of the operation the ether that had been used for extraction is found in one flask, while the extracted fat, ready for weighing is contained in the flask standing alongside the first mentioned, within the same apparatus.

The apparatus consists of the following parts: 1st. A syphon digestor, A, in which the substance to be analysed is placed. The edge of the syphon has a rather broad rim, cut out symmetrically at three points.

*See also: Amer. Chem. Journ. Vol. XI., No. 2, Feb., 1889, pp. 142-144.



2d. Two little flasks B B, the one of which of known weight is destined to receive the extracted fat, while the other one contains the ether, or whatever solvent is used.

3d. The receiver, C, in which the two little flasks stand. Concentric with the upper end of this receiver runs a glass groove or channel R, into which the head piece D, fits. A perfect joint is secured by pouring mercury into the groove.

4th. The headpiece D, in which the digestor is fixed. It ends above in the long tube T, the condensing tube for the vapor of the solvent. At two-thirds of the height of the headpiece on its inside, three little knobs P, are attached upon which rests the rim of the digestor.

5th. The glass tube, T, is fused into the headpiece before the glass blowpipe. It runs as a condensing tube through the Liebig's condenser, L.

The mode of operation of this apparatus is as follows :

The apparatus being perfectly clean and dry, the two little flasks, one of which has been previously weighed and the other one containing ether are put into the receiver. The substance to be extracted, also weighed, enveloped in a filter is put into the digestor, which is suspended inside the headpiece. The digestor with its three cuts in the rim is given a little turn until it passes the knobs and then it is turned again slightly, now resting solidly upon them.

The headpiece is then adapted to the lower part of the apparatus and the mercury forms a joint perfectly proof against the vapors of ether. The digestor must be arranged so that the syphon empties into the neck of the little weighed flask as far down as .5 to 1 cm. Heat is supplied by a water bath.

Towards the end of the extraction, when the ether does not carry any more fatty matter down from the sample into the weighed flask, the water bath is very slightly lowered (about 1 cm.) and the receiver C is given a turn half round, so that the syphon of the digestor now dips into that one of the little flasks B B, which at the beginning of the operation contained the ether. The water bath is adjusted again and the ether collected in the flask in which it was originally contained, while the extracted fatty matter alone remains in the weighed flask. This latter is allowed to dry and cool and is then weighed.

II.

Hydrazin, discovered by Dr. Theodor Curtius, of Erlangen, is, beyond doubt, one of the most interesting of compounds which have recently been made known. The reaction by means of which it is prepared is a decomposition, and an astonishing one, which offers many new suggestions. Generally speaking, the mode of formation of this substance excludes decidedly any preformed wish or intention, on the part of Curtius, of building it up. It was found in the true way of all scientific research, *i. e.*, by careful experiment in a cleverly chosen direction, with no other object than to reveal the truth by conscientious work. About four years ago Curtius began to study in this direction and he has been so fortunate as to find, in the beginning of this year, a substance more interesting than could have been anticipated.

Peter Griess discovered, almost 30 years ago, a class of chemical compounds called diazo compounds. Quite a number of them are well known dyes, and now largely used. Griess' reaction consisted in allowing nitrites to act on the mineral acid salts of organic, and especially of aromatic, amido compounds. Or he allowed nitrous acid to act upon the corresponding amido body, free, or combined with a mineral acid.

For example: *

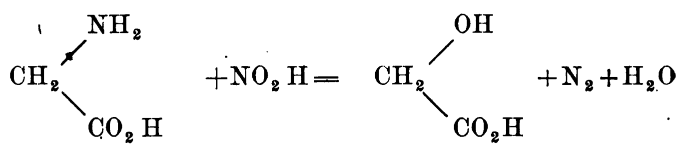
$$\begin{array}{lcl} C_6H_4.NHH.COOH & & C_6H_4N_2COOH \\ & +NOOH= & \quad | \qquad\qquad +2H_2O \\ C_6H_4.NHH.COOH & & C_6H_4NH\ COOH. \\ \text{Amidobenzoic acid.} & & \text{Diazoamidobenzoic acid.} \end{array}$$

* Zeitschrift fur Chemie; 1866, 217.

The group which is characteristic of the diazo compounds is the bivalent group <——N=N——>.

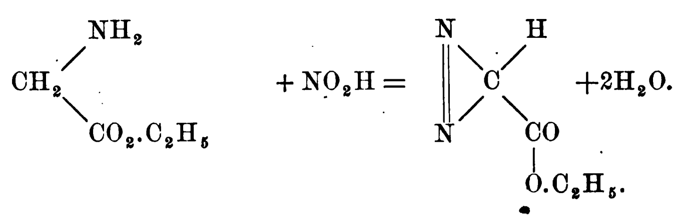
Griess successfully explored this reaction in the broadest possible manner, and was followed by a number of other chemists, but no one ever tested thoroughly the consequences of this reaction in the fatty series, which is what Curtius has just done and with remarkable success.

A simple amido acid of the fatty series is the amidoacetic acid, also called glycocoll, because of its sweetish taste and because it can be prepared from glue. Instead of treating glycocoll directly with nitrous acid, the hydrochloric acid salt of its ethyl ester is used, because a direct treatment of glycocoll with nitrous acid leads to the formation of an oxy-acid, thus :



Glycocoll. Glycollic acid.

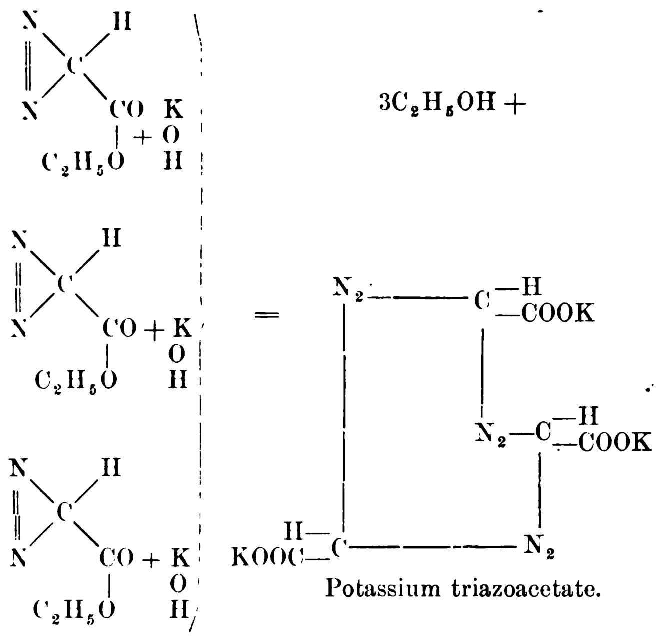
While the ether similarly treated, yields



Glycocoll ethyl ester (or its H Cl salt). Diazoacetic ester.

So differently runs the reaction when different attractive and repulsive chemical forces come into play, as in the substitution of C_2H_5 for one H of the carboxyl group.

When the newly formed diazo compound is treated with caustic alkalies, *i.e.*, is saponified, we obtain salts of triazoacetic acid, $C_3H_3N_6(COOM)_3$, as follows :

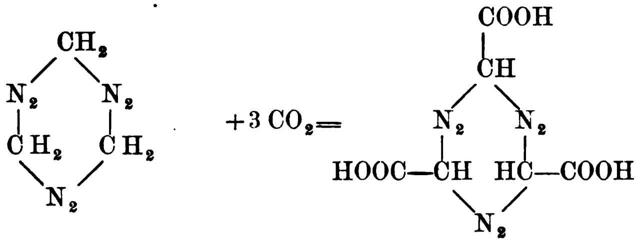


Potassium triazoacetate.

The free acid crystallizes in golden yellow leaflets or in glittering orange colored prisms, melting at 151°. The molecular size of the compounds was ascertained by means of the triazoacetic ethers. The salts of the acid have the normal composition, $C_3H_3N_6(CO_2R)_3$. The potassium salt, for instance, forms orange-yellow prisms of any size. Triazoacetamid is formed by directly heating diazo acetic ether with concentrated aqueous ammonia ; it crystallizes in yellow leaves, which do not melt at 300°.

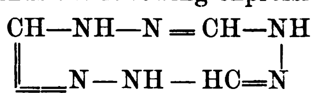
Already at 60° triazoacetic acid splits off its carboxyl groups in the form of carbon dioxide. There remains a substance, $C_3H_6N_6$, crystallizing from a mixture of ether and alcohol in long, colorless hygroscopic needles. The molecular weight of this substance was also determined. Triazoacetic acid can therefore be considered

as the tri-carbon acid of this substance, $C_3H_6N_6$ and, more exactly as tri-carbon acid of triazotrimethylene.



Triazotrimethylene. Triazoacetic acid.

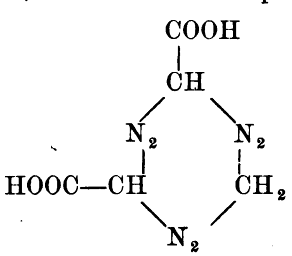
But, since the substance obtained from triazoacetic acid by loss of carbon dioxide, is a *colorless* one, it does *not* contain any diazo-groups. We can assume that one hydrogen atom of the methylene groups has been attracted by the nitrogen, so that the formula for the body $C_3H_6N_6$ finds the following expression :



The behavior of this substance compels the admission that it contains imido groups. It forms with argentic nitrate and with mercuric chloride well characterized double salts of the composition

$$C_3H_6N_6 + 2NO_3\,Ag \text{ and } C_3H_6N_6 + 3HgCl_2.$$

When triazoacetic acid is treated with alkali, carbon dioxide is split off, and, as an intermediate product, a dicarbo acid is formed;



$= C_3H_4N_6(CO_2H)_2$.

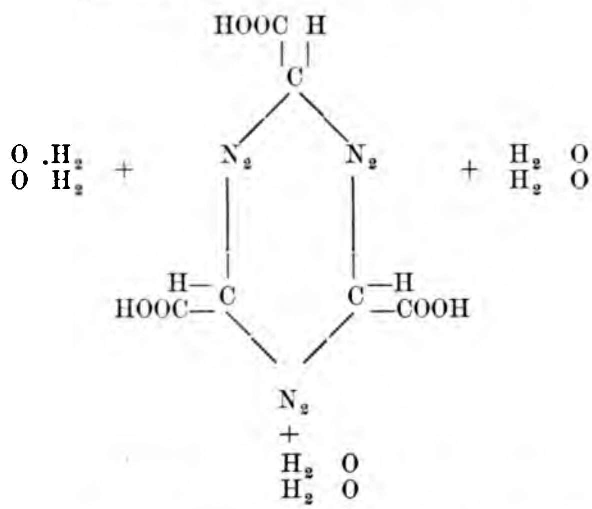
but eventually a substance forms that has, for the simplest expression of its composition, the formula $(C\,N_2\,H_2)_x$, but which is not

identical with the body $C_3\ H_6\ N_6$. The substance forms a normal, colorless silver salt $(CN_2\ Ag_2)_x$, being an entirely different body from cyanamid.

An entirely new reaction takes place when triazoacetic acid is boiled with water or with dilute mineral acids. The condensation ring is then broken and the products of decomposition are carbon dioxyde, formic acid and *hydrazin*.

$$C_3H_3N_6(COOH_3) + 6H_2O = 3CO_2 + 3H.COOH + 3N_2H_4$$

or better, graphically :



Triazoacetic ether is correspondingly decomposed according to the equation

$$C_3H_6N_6(CO_2R)_3 + 6H_2O = 3\begin{array}{l}COO.R\\ |\\ COOH\end{array} + 3N_2H_4$$

i.e., into oxalic ether and hydrazin.

If we boil with dilute sulphuric acid, the hydrazin sulphate, which is very insoluble, separates at once in glittering prisms. The hydrazin forms beautifully crystallizing salts of which the bichlorhydride forms, like ammonium chloride, regular octahedrons. If

this latter salt be heated to 170°, a monochlorhydride is formed, crystallizing in long needles of the formula

$$\begin{array}{l} NH_2.HCl \\ | \\ NH_2 \end{array}$$

The composition gives the molecular weight of hydrazin. Free hydrazin (or diamide) is formed when salts of hydrazin are heated with caustic alkali in a silver still, the vapors being conducted over quicklime. It is a gas of peculiar odor, and but very feebly suggesting ammonia. Since hydrazin attracts water in a very high degree it readily forms a hydrate, which fumes in contact with air, boils without decomposition at 119° and corresponds to the formula

$$\begin{array}{l} NH_2 \\ | \\ NH_3.OH \end{array}$$

Hydrazin is the strongest reducing agent known ; it separates the heavy metals even from their *neutral* salt solutions, for instance, platinum from the solution of its chloride.

In all these reactions the nitrogen escapes as a gas.

If hydrazin sulphate be heated to its melting point (254°), the sulphuric acid radical is not only reduced to sulphur, but even to hydrogen sulphide, and this reaction takes place with explosive force.

Since hydrazin possesses two amido groups of even value, it combines with two molecules of aldehydes. The resulting compounds are bodies of beautiful crystalline form, almost insoluble in water, and are represented as follows :

$$\begin{array}{l} NH_2 \\ | \\ NH_2 \end{array} + \underbrace{\begin{array}{l} CHO.C_6H_5 \\ \\ CHO.C_6H_5 \end{array}}_{\text{Benzaldehyde.}} = \underbrace{\begin{array}{l} N=CH.C_6H_5 \\ | \\ N=CH.C_6H_5 \end{array}}_{\text{Benzal-azin.}} + 2H_2O$$

This benzal-azin is the best form of obtaining hydrazin pure from mixtures. The benzal-azin crystallizes from alcohol in long, light

yellow needles, which melt at 93°, and which, when subjected to distillation, decompose evenly into nitrogen and stilbene :

$$\begin{array}{l} N=CH.C_6H_5 \\ \mid \\ N=CH.C_6H_5 \end{array} = N_2 + \begin{array}{l} CH.C_6H_5 \\ \| \\ CH.C_6H_5 \end{array}$$

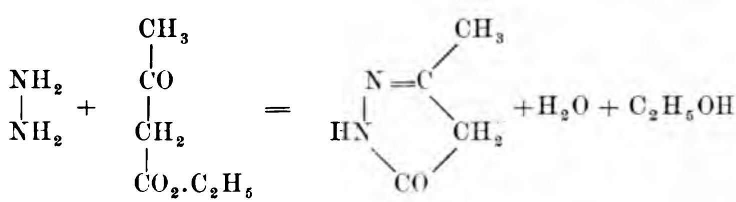
Benzal-azin. Stilbene.

When benzal-azin is boiled with acids the aldehyde is regenerated and the corresponding salt of hydrazin is formed :

$$\begin{array}{l} N=CH.C_6H_5 \\ \mid \\ N=CH.C_6H_5 \end{array} + 2H_2O = \begin{array}{l} NH_2 \\ \mid \\ NH_2 \end{array} + 2CHO.C_6H_5$$

A quite analogous behavior is shown by all the other compounds of aldehydes with hydrazin.

On the other hand, acetacetic ether combines with one molecule of hydrazin, simultaneously losing water and alcohol, to form methyl-pyrazolon, a substance crystallizing in colorless prisms and melting at 216°, thus :



Acetacetic ether. Methyl-pyrazolon.

In methyl-pyrazolon the hydrogen of the imido group can be replaced by silver.

Hydrazin will also unite to form crystallizing compounds with ketones, such as acetophenon or benzil.

College of the City of New York, November, 1888.*

* Printed in October number because of previous delay in publication.

ABSTRACTS.

GENERAL AND INORGANIC CHEMISTRY.

Experiments upon Alum Baking Powders, and the Effects upon Digestion of the Residues Left Therefrom in Bread. J. W. Mallet.

The author concludes as follows:

(*a*) The great part of the alum baking powders in the American market are made with alum, the acid phosphate of calcium, sodium bicarbonate and starch.

(*b*) These powders, as found in retail trade, give off very different proportions of carbonic acid gas, and, therefore, require to be used in different proportion with the same quantity of flour, some of the inferior powders in largely increased amount, to produce the requisite porosity in bread.

(*c*) In these powders there is generally present an excess of the alkaline ingredient but this excess varies in amount, and there is sometimes found, on the contrary, an excess of acid material.

(*d*) On moistening with water these powders, even when containing an excess of alkaline material, yield small quantities of aluminium and calcium in a soluble condition.

(*e*) As a consequence of the common employment of calcium acid phosphate along with alum in the manufacture of baking powders these, after use in bread-making, leave at any rate most of their aluminium in the form of phosphate. When alum alone is used the phosphate is replaced by hydroxide.

(*f*) The temperature to which the interior of bread is exposed in baking does not exceed 212° F.

(*g*) At the temperature of 212° F. neither the "water of combination" of aluminium hydroxide, nor the whole of the associated water of either this or the phosphate, is removed in baking bread containing these substances as residues from baking powder.

(*h*) In doses not very greatly exceeding such quantities as may be derived from bread as commonly used, aluminium hydroxide

and phosphate produce, or produced in experiments upon myself, an inhibitory effect upon gastric digestion.

(*i*) This effect is probably a consequence of the fact that a part of the aluminium unites with the acid of the gastric juice and is taken up into solution, while at the same time the remainder of the aluminium hydroxide or phosphate throws down in insoluble form the organic substance constituting the peptic ferment.

(*k*) Partial precipitation in insoluble form of some of the organic matter of food may probably also be brought about by the presence of the aluminium compounds in question.

(*l*) From the general nature of the results obtained the conclusion may fairly be deduced that, not only alum itself, but the residues which its use in baking prowder leaves in bread, cannot be viewed as harmless but must be ranked as objectionable, and should be avoided when the object aimed at is the production of wholesome bread. (*Chem. News*, **58**, *276*.) W. P. M.

Water Supply to Steam Boilers. T. P. Bruce Warren.

Petroleum or other non-saponifiable lubricators should be used in every case where it is intended to use waste steam, direct, in heating the feed water; otherwise earthy soaps form, are decomposed on the sides of the plates, and, where these greasy spots occur, contact between the water and the metal is prevented. Corrosion is more rapid at these spots, but the nature of the action is obscure.

Magnesium chloride in large quantity is objectionable in a feed water as tending to the generation of hydrochloric acid. (*Chem. News*, **58**, *273*.) W. P. M.

The Calorimetric Bomb as a Combustion Furnace for Ultimate Analysis. Arnold Eiloart.

As elsewhere stated, the bomb is a steel crucible lined with platinum. Through the cover, which screws on air tight, passes a tube with stop-cock and also an insulated platinum wire.

Complete combustion of carbon compounds may be obtained by filling the bomb with oxygen under pressure, and producing ignition by an electric current.

The author suggests the estimation of water and chlorine by introducing small, weighed absorption vessels into the bomb, and allowing sufficient time after the combustion for complete absorption of the products. (*Chem. News,* **58**, *284.*) W. P. M.

Detection of Antimony in Minerals. ALEXANDER JOHNSTONE.

The white coating which appears on charcoal before the blowpipe is moistened with a drop of ammonium sulphide. The characteristic reddish or orange antimony sulphide is immediately formed. (*Chem. New,* **58**, *296.*) W. P. M.

The Sensibility of Earth-Nut Oil to Heat when Electrified. T. P. BRUCE WARREN.

When placed in an inner glass vessel, the annular space (nearly half an inch) between which and the outer glass was packed with paper, the oil was still so sensitive to heat as to cause an instantaneous deflection of the galvanometer when the exterior glass was touched with the finger. A lighted taper at a distance of twelve inches also produced marked deflection. The author asks : "Does electrification increase the susceptibility of bodies to heat?" (*Chem. News,* **58**, *259.*) W. P. M.

JOURNAL

OF THE

AMERICAN CHEMICAL SOCIETY.

VOL. X.—NO. 9.

NOVEMBER,

1888.

COMMITTEE ON PAPERS AND PUBLICATIONS:

LUCIUS PITKIN,
C. F. MCKENNA,
A. A. BRENEMAN, Editor.

ABSTRACTORS:

W. RUPP, M. LIEBSCHÜTZ,
J. F. GEISLER, W. P. MASON.

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JOHN POLHEMUS,
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A. A. BRENEMAN, 97 Water St., New York.

REGULAR MEETING, November 2d, 1888.

Vice-President Breneman in the Chair.

The minutes of the meeting of Oct. 4th were read and approved.

Miuutes of meeting of Board of Directors held Oct. 4th were read.

Messrs. E. Dwight Kendall, 58 Bainbridge street, Brooklyn, and H. P. Curtis, Zylonite Works, Zylonite, Mass., were unanimously elected members.

The following were proposed for membership:

CHAS. T. POMEROY, 226 Halsey Street, Newark, N. J.

Prof. ROBERT W. HALL, University Building, N. Y.

The following papers were then read by Dr. L. H. Friedburg, published in the October number:

"On a New Fat Extractor."

"On Curtius Hydrazin."

The Committee on Nominations presented a ticket for the annual election at the December meeting.

The meeting was then adjourned.

T. D. O'CONNOR,

Recording Secretary.

FATAL POISONING BY CARBON MONOXIDE.

By Prof. W. P. Mason.

In Troy, N. Y., on January 6, 1887, owing to a break in the street mains, a quantity of "Fuel Gas" (see analysis below), passed beneath the frozen crust of earth, and found its way into the adjoining houses. Three deaths, and many more or less serious illnesses, resulted.

The following points, from the testimony of the physicians who made the autopsis are to be noted :

The expressions of the deceased were placid. One victim, an old woman, was found seated in a chair holding her false teeth in her hand. The second, also a woman, lay upon the floor. The third, a man, sat upright on a lounge, his head reclining on his shoulder. The fire was burning in the stove, and the lamps were still burning on the table. When found, death had not been very recent, as "*rigor mortis*" was fully developed.

Very searching autopsis were made, with the result of finding nothing whatever abnormal, with the exception of the bright cherry-red color of the tissues, and the vivid redness and lack of coagula in the blood.

Upon opening the chest cavity the physician bent forward and took one or two long whiffs for the purpose of determing the presence of any odor. Almost immediately he was seized with giddiness and great oppression in the epigastrium, so much so that he had to discontinue his work for half an hour. The effects did not finally wear off until after an interval of about twelve hours.

The painful oppression in the chest, the giddiness and the subsequent headache experienced by this physician, call most forcibly to mind the symptoms described by Sir Humphry Davy, when he so rashly experimented upon himself with carbon monoxide.

A lawsuit naturally growing out of these cases of poisoning, I was called upon to give the chemical constituents found in the said

"Fuel Gas," and the results are appended. I also experimented upon animal life with carbon monoxide mixed with air, obtaining results confirmatory of observations already made, that death usually takes place very quietly, although occasionally with convulsive movements. Chickens and rats were the two forms of life employed.

Blood, treated with carbon monoxide, I found to assume a bright red, almost carmine, color, which did not alter on exposure to air for a number of days.

Finally, in February, 1888, a bottle of blood taken from the heart of one of the victims at the time of the autopsy, was submitted to me for examination. The bottle was closed with a tight cork. Although over a year old, and possessing strong odor of decomposition, the color still remained of the brilliant, vivid red noted at the time of taking the specimen. Under the microscope but very few corpuscles remained to be seen, their structure having almost completely broken down.

Examination by the spectroscope revealed the two absorption bands near the line, characteristic of the presence of carbon monoxide in combination. These bands, although very like those indicative of oxy-haemoglobin, may yet be readily distinguished by their location only, particularly if a sample of blood artificially treated with carbon monoxide be at hand for purposes of comparison.

The space between the bands is, moreover, much less clearly lighted than in the case of oxygenated blood. As a confirmatory test, the blood under examination was treated with solid potassium sulphide, and the absorption bands found unchanged thereby—the bands of oxy-haemoglobin, as is well known, change under such treatment to the single dark band midway between the positions of the former ones.

What is of special interest in this case is the ready detection of carbon monoxide in the blood after so long an interval of time.

At the present moment, nearly two years from the date of the accident, the blood still retains the characteristics noticed when first examined.

The analysis of the Fuel Gas by volume is :

CO_2	5.0	per cent.
O	0.5	"
CO	37.5	"
CH_4	.9	"
H	48.0	"
N	7.1	"

Such gas supplied to consumers is practically odorless.

WILLLIAM P. MASON.

RENSSELAER POLYTECHNIC INSTITUTE,
December 1, 1888.

METHOD OF DETERMINING INDIGOTINE FOR COMMERCIAL PURPOSES.

By F. A. OWEN. (Communicated by A. H. SABIN.)

Shave from the sample two or three grms. fine enough so that 1 grm. can be weighed with exactness; place this 1 grm. on a watch glass and dry at 100° C. When dry, transfer it to a glass mortar and grind as fine as possible dry, then add water and grind to a very thin paste, which is then washed into a 250 c.c. flask. To this add 3 grms. zinc dust and about 6 grms. NaOH, and fill a little above the mark, as the volume diminishes, in an hour or two. The reduction takes place in half an hour to two hours; the flask should be shaken occasionally and when the solution has become green the reduction is complete. If allowed to go too far reddish or brownish streaks appear, which indicate a loss of indigotine. Hydrogen is not given off until the reduction is completed, and froth indicates too much zinc. When the reduction is complete, draw off 50 c.c. of the clear liquor, let it stand exposed to the air half an hour, acidify with HCl, filter through a carefully washed filter, dry at 100° C. and weigh. It is not necessary to take any special care to prevent absorption of moisture in the balance pan. Indigo often loses 20 per cent. in drying, and dry indigo is of good quality if it yields 60 to 62½ per cent., but samples are met with yielding 80 per cent. after drying. The results of this method are in agreement with those obtained in a lime and copperas vat under good management.

ABSTRACTS.

GENERAL AND INORGANIC CHEMISTRY.

Incompleteness of Combustion in Gaseous Explosions. H. B. DIXON and H. W. SMITH.

When a mixture of hydrogen and oxygen, in the proportions in which they combine to form water, was exploded in a leaden tube 100 metres long and 9 m. m. in diameter, there remained an explosive residue. Even with a slight excess of oxygen the hydrogen was not completely burned. From investigation, it appears that although the amount of surface exposed to the gases, has some influence on the amount unburnt, the influence is not very great, and that the incompleteness of the combustion is therefore not due to the cooling action of the surface of the vessel.

The capacity of the above mentioned lead tube was 8100 c. c. and the volume of unconsumed gas varied from 100 c. c. to 250 c. c. Nearly one per cent. of the original detonating gas remained unburnt. (*Chem. News.*, **59**, *65.*) W. P. M.

Coloration of a Coal Fire by Common Salt. NORMAN LEONARD.

The blue flame produced, so different from the well-known sodium flame coloration, has been considered as perhaps due to a union of chlorine with the carbon and hydrogen of the fuel, with formation of compounds such as chloroform and tetrachloride of carbon. This supposition is pretty well borne out by the following facts:

1. The blue flame is not produced when sodium chloride is projected on to a red-hot platinum capsule.
2. The coloration is produced equally well by potassium chloride, and less readily by the chlorides of barium, calcium and ammonium.
3. The coloration is not produced by sodium carbonate, phosphate or sulphate.
4. Chloroform, carbon tetrachloride and ethylene dichloride, when thrown into a coal fire, produce blue colorations similar to that produced by sodium chloride. (*Chem. News*, **59**, *15*).

W. P. M.

ANALYTICAL CHEMISTRY.

Decomposition of Nickel and Cobalt.

The *Chemical News* publishes the following portion of a letter from Proff. Krüss:

"I have in fact succeeded in splitting up nickel and cobalt, each into two parts, and both these metals have one component in common. In concert with my colleague, I sent a brief notice on this subject to the *Berichte*, which will appear in Berlin on Monday next, 21st inst. The matter communicated in this short memoir has been intentionally kept very scanty, and I have given as little room as possible to speculation for fear of being led to assertions which I might perhaps soon have to withdraw. Meantime, I have fully confirmed our first observations, and we have now about ten different methods by which we can resolve these bodies, hitherto regarded as elementary, each into two parts. We shall soon give a full report on our results, but in the meantime I may inform you, as a curious fact, that we have succeeded in obtainin *green* so-called nickel salts from *red* cobalt salts and the *colorless* salts of the substance which accompanies both metals, and further, in transforming some green nickel salts into red cobalt salts and other components.

"This may perhaps sound alchemical, but it cannot be denied. As for the spectra of the three components of cobalt and nickel, we have not as yet, with the ordinary experimental arrangements, observed any characteristic lines. This is doubtless the reason why hitherto no spectral lines have been found common to pure cobalt and nickel." (*Chem. News*, **59**, *39*.) M. P. M.

Analytical Examination of Water for Technical Purposes. A. H. Allen.

Determination of hardness by titration with soap solution is utterly misleading. Although acting more slowly than CaO, still MgO does not possess greater hardening power ; a statement contrary to Wanklyn, who claims that the hardening power of CaO is to that of MgO is as 2 is to 3. If by "hardness" of water is meant its soap destroying power, then no dilution of hard waters should be made previous to addition of the soap solution, inas-

much as the water is not diluted when used ; on the other hand, if "hardness" represents the calcium and magnesium compounds present in the water, the soap test is too crude for use. For determination of "magnesian hardness" Wanklyn suggests the addition of ammonium oxalate powder, filtration and subsequent titration of the filtrate with standard soap solution. The author finds that such procedure does not answer, as the presence of the ammonium salt (other salts of the alkalies acting in a similar manner) has a most marked effect upon the result, the indicated hardness of a magnesian water to which an oxalate has been added, being found to vary with the amount of oxalate employed. The author holds that the day of Clark's soap test has gone by, and that chemists should turn to more accurate methods. Concerning the combination of basic and acid radicals the author believes that magnesium chloride should appear in the analysis to the full extent corresponding to the chlorine and magnesium present, on account of the tendency of magnesium chloride to decompose, on evaporating its solution, with formation of free HCl. Waters containing much $MgCl_2$ corrode the boiler at the water line. The addition of NH_4Cl will prevent the decomposition referred to, and, from experience with sea water, NaCl appears to act the same way. All the calcium, over and above that required to form carbonate, should be expressed as $CaSO_4$, on account of the prominence that should be given to the tendency of the water to form boiler scale. (*J. Soc. Chem. Ind.*, **7**, *795.*) W. P. M.

Estimation of Caustic Alkali in Presence of Alkaline Carbonates. LEONARD DOBBIN.

The method is a kind of inverted "Nessler" test. A solution is prepared of the double potassium and mercury iodide, and a known amount of ammonium chloride is added. Alkaline carbonates give no reaction with this reagent, but a caustic alkali, when added in sufficient quantity to break up all the NH_4Cl. present will give the usual "Nessler" coloration. The ready solubility of the well-known brown precipitate in a solution of NH_4Cl, prevents any formation of color before the whole of the NH_4Cl. has been broken up into free ammonia. With a

standard solution such as the above, and also a standard solution of caustic alkali, the process for quantitative purposes is apparent. For use as a quantitative test for caustic alkali the reagent may be quickly made by taking a small quantity of $HgCl_2$ solution, adding solution of KI until red precipitate just redissolves and then adding a drop of NH_4Cl solution. (*J. Soc. Chem. Ind.* **7**, *829.*)

W. P. M.

New Test for Tannic Acid. S. G. RAWSON.

Ammonium chloride mixed with ammonia, produces in solutions of tannic acid a white precipitate which rapidly becomes reddish brown on exposure to the air. With gallic acid no precipitate falls but the liquid becomes red. In working with dilute solutions of tannic acid it is better to add the ammonia mixture slowly, so that it may float on top. The white precipitate may then be easily seen at the line of separation of the two liquids. (*Chem. News,* **59**, *52.*) W. P. M.

Estimation of Glycerine in Soaps, Leys and Concentrated Glycerine. OTTO HEHNER.

A valuable paper not suitable for abstraction. (*J. Soc. Chem. Ind.*, 8, *4.*) W. P. M.

Testing of Lard for Cotton Seed Oil and Beef Stearine. JOHN PATTISON.

Forty drops of the melted lard are placed in a test tube and dissolved in 10 c. c. ether. Two c. c. alcoholic solution $Ag\,NO_3$ (1 of the salt to 100 alcohol) are added. The tube and its contents are left to stand five or six hours away from the light. If present, cotton seed oil will reduce the silver and imparts a maroon color to the solution. By comparing the depths of color with those produced by lards containing known amounts of cotton seed oil, the quantity present in the sample is estimated.

When searching for beef stearine, prepare an ethereal solution of the lard as above, plug the tube loosely with cotton wool and allow crystals to form by spontaneous evaporation. Under the

microscope the beef stearine crystals form curved tufts somewhat of the shape of the short tail of a horse, with terminals pointed and hair-like. Lard crystals are usually found in oblong plates, occasionally radiated, and have oblique terminals. (*J. Soc. Chem. Ind.*, **8**, *30*.) W. P. M.

INDUSTRIAL CHEMISTRY.

A New Alkali Process. W. W. STAVELEY.

Referring to the many attempts that have been made to decompose $Na_2\ SO_4$, by means of slaked lime, the author states that it occurred to him that, probably at the moment of formation of $Na\ HO$, a reverse action takes place, and that if some body were present which could combine with the $Na\ HO$ at the moment of formation, better results could be obtained. Upon agitating a mixture of $Na_2\ SO_4$ solution and slaked lime and gradually adding cresol thereto, an almost complete decomposition of the sulphate into sodium cresylate was obtained with a precipitation of $Ca\ SO_4$. The sodium cresylate remaining in solution may be readily decomposed by means of CO_2 (fuel or limekiln gases) forming $Na_2\ CO_3$ in solution and liberating the cresol, which will float on the surface as an oily liquid, and may be again employed for another lot of $Na_2\ SO_4$. The paper is a full one and gives some figures as to cost, compared with other processes. (*J. Soc. Chem. Ind.*, **7**, *807*.) W. P. M.

Natural Aperient Bitter Waters. OTTO HEHNER.

It is doubtful if it be generally known by the medical profession that these waters, coming usually from very shallow wells fluctuate in strength almost from day to day. By varying the method of collection, two samples of very different strengths may be taken at the same time, as the stronger water tend to collect at the bottom of the well. In the same brand of water, bought at different times in the London market, the author found the following amount of $Mg\ SO_4$:

1st sample..................215.85 parts per 10000.
2d " ....304.80 " " "

(*Analyst*, **14**, *36*.) W. P. M.

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COMMITTEE ON PAPERS AND PUBLICATIONS:

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A. A. BRENEMAN, 97 Water St., New York.

REGULAR MEETING, Dec. 7th, 1888.

Prof. W. P. Mason in the chair.

The minutes of the preceding meeting were read and approved.

Election of officers for the ensuing year being next in order, the chair appointed Messrs. Munsell and Kent as tellers.

The following officers were elected :

President,

C. F. CHANDLER.

Vice-Presidents,

A. A. BRENEMAN, A. C. HALE,
T. S. HUNT, W. P. MASON,
C. E. MUNROE, J. W. MALLET.

Corresponding Secretary, M. ALSBERG.

Recording Secretary, D. WOODMAN.

Treasurer, J. H. STEBBINS, JR.

Librarian, WM. RUPP.

Curators,

W. H. KENT, F. VANDERPOEL, A. H. SABIN.

Committee on Papers and Publications,

A. C. HALE, A. A. BRENEMAN, J. F. GEISLER.

Committee on Nominations,

M. LEAL, R. W. MOORE, A. EIMER,
A. P. HALLOCK, T. D. O'CONNOR.

Directors,

M. ALSBERG, D. WOODMAN,
J. H. STEBBINS, JR., WM. RUPP,
L. H. FRIEDBURG, H. ENDEMANN,
M. E. WALDSTEIN, C. F. CHANDLER,
T. D. O'CONNOR, W. H. KENT.

It was moved by Dr. Friedburg, that the names of Mendelejeff, Odling and Kékulé, be added to the list of Honorary Members of the Society. Carried.

The following papers were then read by title:

"Fatal Poisoning by Carbon Monoxide." By Prof. W. P. MASON.

"On a New Method for Commercial Analysis of Indigo." By F. A. OWEN. Communicated by A. H. SABIN.

"On a Modification of Gunningham's Blast Lamp." By A. H. SABIN.

The secretary was directed to cast one ballot for the election of ROBERT W. HALL, University Building, N. Y., and C. T. POMEROY, Ph. D., 266 Halsey street, Newark, N. J.

Mr. L. E. MUÑOZ DEL MONTÉ was proposed for membership.

The meeting was then adjourned.

T. D. O'CONNOR,
Recording Secretary.

ABSTRACTS.

GENERAL AND INORGANIC CHEMISTRY.

Decomposition of Potassium Chlorate by Heat in Presence of MnO_2. H. McLeod.

The first action is:

$$2\,MnO_2 + 2KClO_3 = K_2Mn_2O_8 + Cl_2 + O_2.$$

Afterwards by further heating:

$$K_2Mn_2O_8 = K_2MnO_4 + MnO_2 + O_2.$$

The third stage is not so clear; it is very improbable that the manganate is transformed into permanganate by the oxygen from the chlorate. It is more likely that it is acted on by more chlorine produced by the action of the MnO_2 on fresh chlorate, thus:

$$K_2MnO_4 + Cl_2 = 2KCl + MnO_2 + O_2.$$

If the chlorine produced by the action of the MnO_2 directly on the $KClO_3$ is thus absorbed by the manganate, it fully explains the very small quantity of chlorine that is evolved.

Chlorine is certainly evolved as soon as the action commences. The author finds that the MnO_2 cannot, as has been stated, be exhausted by use; it enters into chemical reaction and is reproduced. (*J. Chem. Soc.*, **55**, *184*.) W. P. M.

On a New Acid of Tin. W. Spring.

The author has found a combination of the formula $H_2\,Sn_2\,O_7$, of the type of disulphuric acid, $H_2\,S_2\,O_7$, or dichromic acid, $H_2\,Cr_2\,O_7$.

A solution of stannous chloride $Sn\,Cl_2$, in a solution slightly acidulated with $H\,Cl$ is treated with an excess of pure barium binoxide; the tin oxide remains in a colloidal state, and is separated from the barium chloride by dialysis. The solution free of $Ba\,Cl_2$ is evaporated on the water bath; the result is a white mass the analyses of which gives

		Calculated for $H_2\,Sn_2\,O_7$.
Sn	67.33	67.40
$H_2\,O$	5.40	5.14
O	27.16	27.46

These determinations lead to the conclusion of the existence of the compound $Sn\ O_3$, capable of remaining in combination with water at 100° to form $2SnO_3$, H_2O or $H_2Sn_2O_7$. The author expects to study the mechanism of the transformations by the barium binoxide. (*Bul. Soc. Chim.*, **51**, *182.*) M. L.

Analysis of Waters of the Yellowstone National Park. F. A. GOOCH AND J. E. WHITFIELD.

This excellent paper, from *Bulletin of the U. S. Geological Survey, No. 47*, is printed in full in the *Chemical News*, beginning with **59**–113. A full account is given of the analytical methods employed. W. P. M.

ORGANIC CHEMISTRY.

Starch Iodide. SEYFERT.

Pfeiffer and Tollens have decided that the formula of starch is $C_{24}H_{40}O_{20}$, and that of the iodide $(C_{24}H_{40}O_{20})_6I_7$, containing 22.865 per cent. I. On this basis it is proposed to determine starch by dissolving one grm. in water, cooling, adding 50 c.c. of iodine solution, 20 c.c. concentrated HCl, and diluting to 500 c.c. After vigorous shaking, the starch iodide is allowed to settle, and in an aliquot portion of the clear liquid the excess of iodine present is determined by hyposulphite. The iodine solution contains 12 or 13 gms. I per litre, with sufficient KI to effect solution. The amount of iodine absorbed by the starch, multiplied by 4.37, gives the amount of starch present. (*Dingl. Jour.*, **271**, *189.*)
E. W.

On Dioxethyl Acetone. E. GRIMAUX and L. LEFEVRE.

Theory indicates the existence of two isomeric derivatives of glycerine by loss of hydrogen, glyceric aldehyde and dioxacetone. The first has been obtained by one of the authors by the oxidation of glycerine by platinum black, and he has shown that it is a true fermentable sugar; the authors in trying to obtain dioxacetone have obtained its dioxyethyl derivative.

$$CH_2\,OC_2\,H_5 - CO - CH_2\,OC_2\,H_5.$$

The paper concludes with the preparation of dioxethylacetone by the use of ethoxaceto-ethoxacetic ether, and descriptions of dioxethylacetone ; the latter strongly reduces cupro-potassic solutions, etc., etc. (*Bul. Soc. Chim.*, **51, 1.**, *15.*) M. L.

Reduction of Cupric Salts by Sugars. M. MOUNET.

A solution of saccharose, saturated at ordinary temperatures, precipitates metallic copper if sulphate of this metal be added, after a few minutes boiling. Invertion precedes as the solution acts strongly afterwards on the cupro potassic solution.

Lactose and dextrose act similarly, but more slowly.

The reduction takes place at any temperature, being slower at low temperatures.

Cupro-potassic solution is entirely reduced by concentrate solution of sugar, at ebullition; there is production of the yellow cuprous oxide, changing after ebullition to red anhydrous oxide; with dextrose and lactose the red oxide appears at once. There is always transformation, after long ebullition, of the oxide into metallic copper, etc., etc. (*Bul. Soc. Chim.*, **51,** *2–83.*) M. L.

Manufacture of Iodoform. H. SUILLOTS and H. RAYNAUD.

The purpose of the authors was to manufacture iodoform with acetone and to transform all the iodine in iodoform. Basing themselves on the theory that the sodium hydrate transforms the iodine into hypoiodite, which subsequently acts on the acetone, the authors have thought of employing a hypochlorite added to an iodide. If, as they say, they take 1 mol. acetone = 58, and 3 potass. iodide = 498, there is, after action of sodium hypochlorite in slight excess, 1 mol. of iodoform formed = 394. The reaction is represented by :

$$KI + K\,Cl\,O_2 = K\,Cl + K\,I\,O_2$$

$$C_6\,H_6\,O_2 + 3\,(K\,IO_2) = C_2\,HI_3 + K\,C_4\,H_3\,O_4 + 2(K\,HO_2)^*.$$

The authors have by this process manufactured iodoform on a large scale from the ashes of sea weed. (*Bul. Soc. Chim.*, **51, 1,** *4.*)

* (O=8.)

Composition of Milk. P. VIETH.

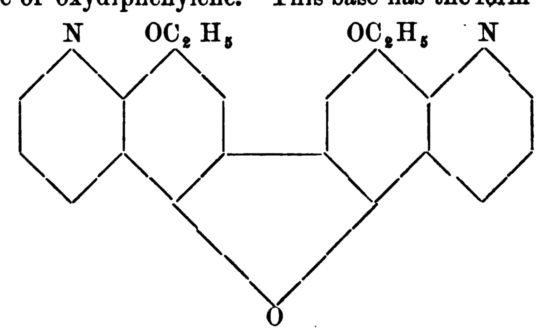
During the year 1888 there were 12,682 samples of milk taken from the railway churns for analysis in the author's laboratory. The results are as follows :

1888.	Specific Gravity.	Total Solids.	Fat.	Solids not Fat.
January	1.0325	12.97	3.79	9.18
February	1.0325	13.00	3.81	9.19
March	1.0325	12.90	3.73	9.17
April	1.0324	12.81	3.68	9.13
May	1.0324	12.82	3.69	9.13
June	1.0324	12.83	3.69	9.14
July	1.0320	12.82	3.76	9.06
August	1.0319	12.84	3.80	9.04
September	1.0322	13.06	3.94	9.12
October	1.0325	13.09	3.89	9.20
November	1.0322	13.18	4.03	9.15
December	1.0321	13.01	3.91	9.10
Yearly average	1.0323	12.94	3.81	9.13

—*Analyst*, **14**, *69*. W. P. M.

On a Diquinoleic Base. ALBERT COLSON.

The author expresses the opinion that quinine is the hydride of a base resulting from the union of 2 mols. of quinoleine, an opinion not destroyed by the results of the oxidation of quinine made by M. Skraup. To try to throw some light on the constitution of quinine the author has had in view the formation of a diquinoleic base of known constitution and the comparison of its reaction with quinine. He describes this base and the mode of obtaining a diquinoleic base, which is dioxethylized, and seemingly a derivative of oxydiphenylene. This base has the form



The author describes its properties and concludes, from its mode of formation and the composition of its chloroplatinate, that there is no doubt about its molecular weight nor the position occupied by the quinoleic hydrogen. (*Bul. Soc. Chim.*, [3] **1,** *169.*) M. L.

Gymnemic Acid. DAVID HOOPER.

This acid is prepared from a plant (*Gymnema sylvestre*) the leaves of which have the peculiar property of destroying the power of the tongue to appreciate the taste of sweet substances. It is a brittle, black, resinous substance, of a greenish color when powdered and is best prepared from the leaf (where it exists as a potassium salt) by treating the aqueous solution of the alcoholic extract with a mineral acid, washing the precipitate and drying in a current of hot air over a desiccator. The formula is $H(C_{32}H_{54}O_{12})$. (*Chem. News*, **59,** *159.*) W. P. M.

Transformation of Terpilenol into a Menthenol. G. BOUCHARDAT and J. LAFONT.

The authors have prepared terpilenol di-iodhydrate, $C_{20}\ H_{16}$ 2HI, by the action of iodhydric acid or terpine $C_{20}\ H_{16}\ 3H_2\ O_2$. The principal product is a body isomeric if not identical with menthol-iodhydric ether, $C_{20}\ H_{19}I$. The body obtained and described by the authors has a composition identical with that obtained by Oppenheim by the action of H Cl on the *menthol* $C_{20}\ H_{20}\ O_2$.

From this experiment the natural menthol ought to be allied to the *terpilenol* series. This menthol $C_{20}\ H_{18}\ O_2$ having with terpilenol, $C_{20}\ H_{18}\ O_2$, relations comparable to those which connect allylic alcohol, $C_6\ H_6\ O_2$, to propylic alcohol, $C_6\ H_8\ O_2$.* (*Bul. Soc. Chim.*, **51,** *No. I, 8.*) M. L.

* O—8.

ANALYTICAL CHEMISTRY.

Determination of Nitric Acid. H. WILFARTH.

This method is a modification of Schlösing's, based on the decomposition of nitrates by an acid solution of ferrous chloride. The liberated nitric oxide is collected and oxidized in an alkaline solution of hydrogen peroxide and the nitric acid formed determined by the amount of alkali thus neutralized. The entire operation for determining the nitric acid by this method may be accomplished within 30 minutes when the apparatus is in working order. The working of the apparatus can only be understood with the aid of the diagram. (*Ztschr. anal. Chem.*, **27**, *441.*)

J. F. G.

On the Use of Hydrogen Peroxide for the Determination of the Metals of the Iron Family. A. CARNOT.

Chronium.—The action of chromic acid on peroxide hydrogen has long been known to have been first indicated by Barroswil; M. Mossin has shown that it is due to a combination of chromic acid and of $HO_2(Cr\ O_3HO_2)$. The author has found that after the peroxide has acted the chromic acid is reduced as chromium sesquioxide, and a corresponding quantity of peroxide has been destroyed. This phenomenon is employed by the author to determine hydrogen peroxide by means of a standard solution of bichromate, but better for the determination of chromic acid or a chromate. The peroxide employed is poured drop by drop in the slightly acid chromate solution till the blue color is no longer produced; a similar operation is performed with a chromate of known strength (bichromate). It is well not to act on more than 200 or 300 grms. of chromic acid. (*Bull. Soc. Chim.*, **1**, [*3*] *275.*) M. L.

On the Use of Peroxide of Hydrogen for the Determination of Metals of the Iron Family. 1st, Chromium; 2d, Manganese; 3d, Iron. A. CARNOT.

Chromium.—If hydrogen peroxide reduces chromic acid in a cold and acid oxide solution, it peroxidizes chromium, on the contrary, in a hot and alkaline or ammoniacal solution. On this is

based the gravimetric determination of chromium ; the chromium will be peroxidized in an ammoniacal solution and then, when oxidized, liberated as chromic acid by the peroxide method, or any other. The same reagent can be employed for gravimetric analysis, the chromate formed will be separated from the oxides thrown down by NH_3 or its carbonate. The chromate left is then reduced by the peroxide in the acid solution, and the excess of peroxide boiled off. To be sure of its entire destruction H_2S is passed into the hot solution ; the chromium oxide is then thrown down by NH_3. Another way is to add to the solution just reduced by the hydrogen peroxide, sodium phosphate and then sodium acetate and ammonia and boil 10 or 15 minutes. Under these conditions there is obtained the precipitate of hydrated chromium oxide, the formation of which under these circumstances has already been indicated by the author. (*C. R.*, **93**, *154.*)

Manganese.—In an ammoniacal solution of a manganous salt hydrogen peroxide precipitates a brown manganese oxide, but the precipitate retains the other bases, and it is necessary to reprecipitate several times to secure good results. The volumetric process, on the contrary, is reliable ; the author has assured himself that the composition of the precipitated oxide is constant and is represented by Mn_6O_{11} or $5MnO_2MnO$), whether the foreign metals be calcium, baryum, zinc or iron. The available oxygen is then calculated volumetrically with oxalic acid, sulphuric acid and standard permanganate, the manganese being calculated on the basis of 5 equivalents of available oxygen corresponding to 6 equivalents of manganese.

Iron—Is peroxidized in the cold and in an acid solution by H_2O_2 better than by any other peroxidizing agent. (*Bull. Soc. Chim.* [3] **1**, *877.*) M. L.

Determination of Lithium by the Fluorides. A. Carnot.

The author has found that lithium fluoride is very sparingly oluble in cold water, and much less so in a solution of ammoniums fluoride. The author indicates the purification of this reagent. The solution of the alkaline earths is evaporated to a few c. c. in

a tared platinum capsule ; ammonium fluoride is added with an excess of ammonia. A gelatinous precipitate is formed which is complete after a day ; a portion of the liquid is decanted on a very small filter, and replaced by a few c. c. of ammoniacal ammonium fluoride, stirred with the platinum spatula, and left to stand ; this treatment is repeated several times ; finally there remains only all the lithium impregnated only with NH_3 and ammonium fluoride. All volatile matter is evaporated off, the ash of filter is added, is treated with H_2SO_4 and calcined to obtain neutral lithium sulphate.

The results must be corrected for the solubility in washing solutions (30—50 c. c.) increasing results by 1 mg. of lithium for every 7 c. c. of wash waters. The results, according to the author, are very satisfactory. (*Bul. Soc. Chim.* [3] **1**, *280.*)

M. L.

Determination of Ash. F. A. FLÜCKIGER.

The author calls attention to the suggestion of R. Fresenius (Quant. anal. II., p. 638) relative to determining ash in organic matter. The substance should be heated in a platinum dish at a temperature just sufficient to char the organic matter without igniting it. The charred mass is then moistened with water, evaporated and finally ignited. The carbon will then readily burn off. (*Ztschr. anal. Chem.*, **27**, *p. 637.*) J. F. G.

Improved Method for Analysis of Fats and Oils. MUTER and DE KONINGH.

A modified form of Muter's fat tube is used. 3 gms. of the fat are saponified by a fragment of KHO and 50 c.c. of alcohol, in a flask closed by a cork carrying a long tube the extremity of which is drawn to a fine point. After saponification, a drop of phenol phthalein solution is added, then acetic acid to slight acidity, then alcoholic potash to *faint* alkalinity. Then 200 c.c. boiling distilled water are placed in an evaporating dish, 30 c.c. of a 10 per cent. solution of Pb $(C_2H_3O_2)_2$ added, and the whole brought to a boil. Pour in the soap solution slowly with constant stirring, and cool slowly. Wash with boiling water by decantation. Scrape the

precip. into a stoppered bottle, pour on 80 c.c. *redist'd* ether, rinse up to 120 c.c. ether. Let stand 12 hours. Filter into the "fat tube," and wash with ether (about 100 c.c.) till no reaction for Pb through a filter kept covered. Pour in about 40 c.c. HCl (1:4), shake until it clears readily, let stand. Wash with water till acid removed. Make up ether solution to (say) 200 c.c. Evap. off 50 c.c. ether (not quite). Add 50 c.c. alcohol and titrate; 1 c.c.=0.0282 oleic. Run out what will give 0.5 gm. oleic, Pass CO_2, to vaporize the ether (120° C.) Add 50 c.c. Hubl solution. Run a blank. Let stand in dark 12 hrs., 35 c.c. KI, $CHCl_3$ titr. (*Analyst*, **14**, *61*.) E. W.

Citric Acid in Lemon Juice. WILLIAMS.

The tests made are specific gravity, acidity by normal soda with phenol phthalein indicator, precipitation with moderate excess of $Ca\ Cl_2$ solution, filtering, ignition of the precipitate to carbonate, and titration of this with normal HCl. Titration with sodium carbonate and litmus paper is troublesome and inaccurate. (*Analyst*, **14**, *25*.) E. W.

New Pepper Adulterant. STODDART.

A mixture of rice starch, barytes, calcium carbonate and lead chromate. The author separates by means of chloroform, and then submits the residue to examination. (*Analyst*, **14**, *37*.) E. W.

Delicate Reaction for Fir Resin. MORAWSKI.

Dissolve in a little glacial acetic acid, with gentle heat, cool, and add a drop of concentrated sulphuric acid to the solution. An intense, though evanescent, reddish to bluish violet color is produced. The test can be applied to the detection of resin in paper, in soaps and in beeswax. (*Dingl.*, **271**, *47*.) E. W.

Acetone in Methyl Alcohol. MESSINGER.

The titration requires, I. $^N/_5$ iodine solution (in KI). II, $^N/_{10}$ $Na_2S_2O_3$. III. HCl (Sp. Gr. 1.025). IV. 56 gms. K HO in 1 l. water. V. flask with ground stopper, 250 c.c. capacity. VI. a 1 c.c. pipette graduated to hundredths or to tenths. VII. Starch

solution. Determine beforehand the proportion of K NO_2 as impurity in the K HO for No. IV, by acidifying 20 c.c. of the solution with the HCl, after addition of 0.1 to 0.2 gms. KI, and titrating with the $Na_2S_2O_3$.

Mix 20 or 30 c.c. of the KOH solution (exactly measured) with 1–2 c.c. of the methyl alcohol to be tested, in the flask, and shake vigorously. Then run in a measured quantity of the iodine solution (20 to 30 c.c.), shake for 15 or 30 seconds, till the solution becomes clear, acidify with the HCl, add an excess of the $Na_2S_2O_3$ solution, then add starch and titrate back with the I solution. The reactions are:

$$2C_3H_6O + 12I + 6KHO = 2C_3H_3I_3O + 6KI + 6H_2O.$$
$$2C_3H_3I_3O + 2KOH = 2CHI_3 + 2KC_2H_3O_2.$$

The excess of iodine reacts thus:

$$I_2 + 2KOH = KOI + KI + H_2O$$

58 of acetone require 762 of I, or, if 1 grm. of material were taken, 100 cc. of the alcohol contained 7.612 times the weight of I absorbed. (*Ber. d. Chem. Ges.*, **21**, *3366.*) E. W.

Determination of Glycerin. BENEDIKT and CANTOR.

By converting it into triacetin, which is then determined. Boil 1 to 1.5 grms. of the sample (with return cooler) for an hour or more with 7 to 8 grms. glacial acetic acid and 3 grms. dehydrated sodium acetate. Cool, dilute with 50 c.c. water, and warm (with return cooler) to incipient boiling. When the oil is dissolved, filter, *cool completely* and then add phenol phthalein, and neutralize exactly with dilute soda, not over half normal. Then add 25 c.c. of a standardized solution of soda, about 10 per cent., boil for 15 minutes and titrate back with half normal HCl.

The first neutralization with soda removes the excess of acetic acid. The second addition of soda saponifies the triacetin, the latter part of the process being similar to the Kœttstorfer titration. The process is applicable to crude glycerins, and also to the determinations of mono-, di- and triglycerides in fats. (*Dingl. Jour.*, **271**, *91.*) E. W.

Determination of Glycerine by Oxidation. V. PLANCHON.

Fox and Wanklyn have proposed oxidation in an alkaline solution by potassium permanganate and determination of the oxalic acid formed. The author proposes to employ an acid solution in which the whole of the glycerine is transformed into carbonic acid by oxidation with the permanganate

$$C_3H_8O_3+7O=3CO_2+4H_2O$$

The CO_2 formed is absorbed and weighed. (*C. R.* 1888, **107**, *246.*) M. L.

Determination of Albumen in Urine. H. SCHAUMANN.

The author inserts a plug of cotton into a suitable glass tube and uses this as a medium for collecting the precipitated albumen. The washed precipitate is then dried in the tube by connecting the latter with an aspiratos and drawing dry air through the tube at a temperature of 100° to 110°C. After two hours drying the weighings are made at intervals of ½ hour until the weight is constant. (*Ztschr. anal. Chem.*, **27**, *p. 635.*) J. F. G.

INDUSTRIAL CHEMISTRY.

Some Industrial Applications of Oxygen. L. T. THORNE.

In bleaching with chlorine compounds, while nascent oxygen is recognized as the active agent, all attempts to employ free oxygen alone have proved unavailing. It is found, however, that when used in conjunction with chlorine, oxygen causes a more rapid decoloration than chlorine alone. It is probable that the bleaching of fibrous materials does not take place at one bound, but by stages, some of the intermediate products being of an aldehydic or unstable character, and oxidizable by free oxygen. If no free oxygen be added, the end as well as the initial oxydation must be effected by nascent oxygen supplied through the medium of

NOTE.—It is probable that this method is not applicable in cases where the glycerine is not pure, (when mixed, for instance, with sugars, or alcohols, etc.), for the same reason that renders the Fox and Wanklyn method unreliable in many other cases. M. L.

chlorine; but if abundance of free oxygen be present, less nascent oxygen, and consequently less chlorine, is required. The saving of bleaching material is very marked.

In the purification of gas, if a little oxygen ($\frac{1}{10}$ per cent. of the volume of the gas for every 100 grains of sulphur per 100 feet crude gas) be added before the gas enters the purifiers, the lime purifiers alone will be found sufficient to remove the sulphur compounds and the life of the lime will be nearly doubled.

Maturing of spirits.—It has been found that if oxygen be forced into spirits at a pressure of one or more atmospheres and left for ten days or so, the spirits become mellowed to the extent of about three to five years ageing. The process is not applicable to wines, as they are often acidified by it. The author quotes the price of oxygen for use upon an industrial scale as \$1.25 to \$1.75 per thousand cubic feet. (*J. Soc. Chem. Ind.*, **8**, *82*.)

W. P. M.

TITLES OF PAPERS READ BEFORE THE AMERICAN CHEMICAL SOCIETY DURING THE YEAR 1888.

ERRATA.

Page 98. For Friedbvrg read Friedburg.

Page 115, bottom. For J. Soc. Chem. Ind. *17* read 7.

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